Phytotoxicity Tests on soils from the Grant-Kohrs Ranch National Historic Site, Deer Lodge, Montana

final

prepared for the

University of Montana, Missoula

Under Contract to the National Park Service

January 2002

by

Lawrence A. Kapustka, Ph.D.

ecological **p**lanning and **t**oxicology, inc.
5010 SW Hout Street
Corvallis, OR 9733-9540

T: 541 752 3707
F: 541 753 9010
E: Kapustka@ep-and-t.com

preface

This report describes phytotoxicity test results from studies conducted by **ep** and **t** in the fall of 2000 through the summer of 2001. The sampling design in 2000 was coordinated with the microbial investigations directed by Dr. Jim Gannon, University of Montana. Soil Samples were collected by staff from the Grant-Kohrs Ranch in September 2000 and in May 2001. Chemical analysis of samples taken by Dr. Gannon was performed by the Geochemistry lab of Dr. Johnnie Moore, University of Montana. The sampling design in 2001 expanded upon the basic design used in 2000, but individual plots were enlarged to accommodate measurements of vegetation cover, composition, and growth.

Aboveground vegetation was clipped at each of four sub-plots at each location by Peter Rice and co-workers. Two sub-plots were clipped in late-May through early-June and all four were clipped in late-July through mid-August 2001. Clip-plot data were sent to **ep** and **t** for inclusion in this phytotoxicity data report.

An additional study was performed to address phytotoxicity in relation to dynamics of buried tailings in GRKO riparian area. Field plots were installed on three slickens areas. Assistance with installation was provided by Dr. Moore and his staff of the University of Montana; Greg Nottingham, and Jill Eckberg of GRKO; and Susan Kristoferson. Ms Eckberg irrigated the plots for three weeks after planting and provided weekly observations throughout the summer. Ms Eckberg also assisted with harvest at the end of the study.

The primary purposes of this report are to describe work undertaken and organize the data from the in-life portion of the toxicity tests into a concise report. Subsequent efforts will focus on interpretation of results and integration with other investigations that comprise this effort to characterize the possible injury to natural resources of Trustee lands due to releases of hazardous materials.

Personnel from ep and t involved in the phytotoxicity tests.	
Project Title	**Person**
Principal Investigator	Lawrence A. Kapustka, Ph.D.
Technician	Alicia Lyman-Holt
Technician	Nathan McConnell
Technician	Joan Yocum
Technician	Susan L. Kristoferson
Contracts/Data Manager	Elizabeth A. Kapustka

executive summary

Phytotoxicity of soils from the Grant-Kohrs Ranch (GRKO) Montana was assessed in laboratory and field tests conducted by **e**cological **p**lanning and **t**oxicology, inc. Laboratory tests followed the ASTM E1963-98 *Standard Guide for Conducting Plant Toxicity Tests*. Forty-five soil samples were collected from the GRKO and shipped to **ep** and **t** in Corvallis, OR for testing. Additional tests were conducted to examine the dynamics of buried tailings, in terms of the potential movement of toxic constituents and the resulting phytotoxic responses. Three sets of field plots and a companion set of laboratory tests were performed using tailings buried at different depths.

The objective of these studies of injury to soils from metals favored the use of non-standardized test species, which necessitated some changes in test species over the two years. Tests conducted in 2000 used alder, alfalfa, dogwood, and sedge. Tests conducted in 2001 used alfalfa and alder; alder seedlings were used, as no viable seeds were available from suppliers. Tests consisted of five replicates of each species for each of the 45 soils and the Positive and Negative Controls. Weekly observations were made noting plant appearance, relative height, and numbers of surviving plants. At harvest, measurement endpoints were: number of plants surviving, color and appearance of shoots and roots, shoot height, root length, shoot mass, and root mass. The mean total plant mass was obtained for each replicate by adding the mean shoot and root mass values. For alfalfa, the number of nodules formed by the nitrogen fixing bacterium *Rhizobium* was also counted. Performance of control plants and environmental parameters during the test were within nominal ranges, indicating the tests were valid for the purposes of evaluating phytotoxic responses.

The endpoints that showed the greatest phytotoxic response were mean nodule number (in alfalfa), root dry weight, total dry weight per plant, and total dry weight per pot. The endpoints that showed the least phytotoxic response were emergence, and shoot appearance and shoot color and during the first and second week of growth. A phytotoxicity scoring system identified seven soil samples as *severely phytotoxic*; 12 as *highly phytotoxic*; 18 as *moderately phytotoxic*; and six as *mildly phytotoxic*; and two as *non-phytotoxic*.

Soil contaminant levels, in particular arsenic (As), copper (Cu), and zinc (Zn), in association with soil pH resulted in statistically significant and biologically relevant phytotoxic responses of plants. Linear and non-linear regressions revealed strong negative relationships between pH-adjusted metal concentrations and endpoints indicative of phytotoxicity (i.e., as metal levels increased, plant growth decreased). The greatest effects were seen in alfalfa and dogwood early seedling growth, and one-year old alder seedlings. Large variations within treatments in alder and sedge grown from seeds obscured phytotoxic effects, but still showed decreased growth with increasing metals concentrations.

Measurement of aboveground vegetation growth in the field was determined for two periods during the summer of 2001. Early season growth was determined from clip-plots harvested in late-May through early-June. Peak standing crop was measured from companion sub-plots harvested in late-July through mid-August. Regrowth was measured in late-July through mid-August on the sub-plots that were clipped in late-May through early-June. Phytomass decreased with increasing levels of contaminants. The pH-adjusted metal concentration used in the laboratory phytotoxicity analyses showed significant negative relationships (i.e., as metal levels increased, plant growth decreased) for both as standing crop and re-growth. The strongest relationship was evident for forbs. Megaplot phytomass growth and growth in laboratory phytotoxicity tests were highly similar, with 60% of the variability accounted for. Together these establish a strong connection between the laboratory results and field observations linking impairment to levels of CoC.

Field plots and laboratory studies of buried tailings demonstrated that phytotoxic responses result as roots penetrate uncontaminated soils and reach the vicinity of buried tailings. Effects appear to be both avoidance of the contaminated zone and direct toxicity[1], especially when the layer of uncontaminated soil is shallow (i.e., <20 cm thick).

[1] Avoidance occurs as root elongation diminishes or stops in the direction of contamination, but roots may continue to grow elsewhere in the root zone; total root mass may be unchanged relative to controls. Direct phytotoxicity is indicated if total root mass is less relative to controls.

table of contents

list of figures

list of tables

abbreviations

As ..... arsenic

C ..... Celsius

Cd .....Cadmium

cm ..... centimeter

Cu ..... copper

ep and **t** .....**e**cological **p**lanning and **t**oxicology, inc.

g .....gram

GRKO ..... Grant-Kohrs Ranch National Historic Site

mm .....millimeter

NRDA .....Natural Resource Damage Assessment

PAR .....Photosynthetically Active Radiation

Pb ..... lead

PH ..... negative log of hydrogen ion concentration

ppm .....part per million

RH ..... Relative Humidity

s ..... second

μmol ..... micromole

Zn .....zinc

1) introduction

ecological **p**lanning and **t**oxicology, inc. was contracted to perform laboratory phytotoxicity tests on a series of environmental samples from the Grant-Kohrs Ranch, Deer Lodge, Montana. The tests followed procedures described in the ASTM E1963-98 *Standard Guide for Conducting Plant Toxicity Tests* (ASTM, 2000). The scope of work performed by **ep** and **t** was to assist with development of the study design, the conduct of the laboratory toxicity tests, design and installation of field plots, collection and analyses of data, and preparation of the report.

a) setting

The area, which has become the Grant-Kohrs Ranch National Historic Site (GRKO) near Deer Lodge, Montana, has been subjected to the release of hazardous substances originating in Butte and Anaconda, Montana for over the last 100 years. The major contaminants of riparian soils include arsenic (As), copper (Cu), cadmium (Cd), lead (Pb), zinc (Zn), and acid generating materials. GRKO is conducting a Natural Resource Damage Assessment (NRDA) to:

1) determine and quantify the extent of injury (if any) to natural resources; and
2) develop a monetary claim for the restoration of injured resources (if any).[2]

The primary component of the GRKO NRDA is the determination of injury to soils. Regulations (43 C.F.R. 11) pertaining to NRDA investigations provide procedures and criteria for such determinations. The GRKO NRDA schedule is driven by the requirements of the Streamside Tailings Operable Unit and Federal and Tribal Natural Resource Damage Consent Decree. That judicially approved schedule requires that GRKO complete its NRDA prior to release of the Record of Decision by the US EPA. Because time is of the critical essence here, GRKO needs to develop its NRDA using procedures identified in the regulations, which will be employed by recognized experts with experience in NRDA in the CFROU.

b) objectives

The tests performed by **ep** and **t** were intended:

1) to characterize the magnitude of phytotoxic response to contaminants in soils from the GRKO;
2) to characterize the dynamic relationships of contaminants in buried tailings in terms of phytotoxic potential; and
3) to supplement work performed by other scientists on soil chemistry, microbial ecology, and vegetation characteristics of the affected areas.

2) materials and methods

The tests were conducted on 15 samples in 2000 and 30 samples in 2001 collected from the GRKO. Artificial soil was used for negative and positive controls for each test. Four test species (alder, alfalfa, dogwood, and sedge) were used in 2000 and two species (alfalfa, alder) were used in 2001[3]. Additional laboratory tests were conducted using tailings to characterize the phytotoxic response of test plants exposed to tailings buried at various depths. Field studies examining the response of plants exposed to tailings buried at various depths were also performed.

---

[2] GRKO is conducting a modified Type B NRDA under regulations contained at 43 C.F.R. Part 11.

[3] In order to maximize the number of samples assessed for microbial functions, vegetation characteristics, and phytotoxicity while minimizing costs, the number of species tested in 2001 was reduced from four to two

a) soil samples

The sampling design used to collect the soil samples (Figure 1) was developed in collaboration with Dr. Jim Gannon, Dr. Johnnie Moore, and Peter Rice of the University of Montana, Missoula.[4] Soil samples in 2000 were collected by Grant-Kohrs Ranch staff and shipped to **ep** and **t** at 5010 SW Hout Street, Corvallis, OR via Fed Ex in doubled plastic sealed bags. Sample identification codes for the 15 samples in 2000 were those of Dr. Gannon (i.e., MT-01 through MT-15). Chain-of-Custody forms were executed by Alicia Lyman-Holt upon receipt of samples on 15 and 20 September 2000. Four subsamples were received from each sample location. These were sieved through a 2 mm mesh screen to remove gravel, roots, and other debris. After sieving, the four subsamples were composited and mixed thoroughly to make a single sample prior to distribution into test units.

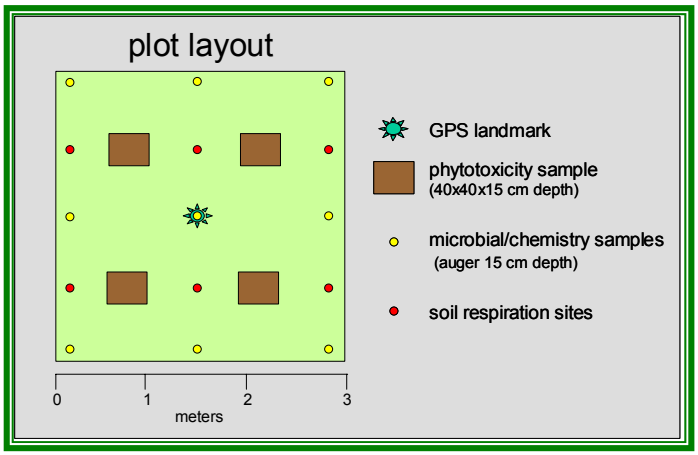


Figure 1. Layout of sample area for samples from 2000.

The sample design was modified for 2001 to accommodate co-located sampling of vegetative cover and aboveground plant growth (Figure 2).[5] Sample identification codes for the 30 samples in 2001 were those of Dr. Moore (i.e., MP-01 through MP-100). Chain-of-Custody forms were executed by Alicia Lyman-Holt upon receipt of samples on 4, 11, and 15 May 2001 and by Joan M. Yocum upon receipt of samples on 29 May 2001. Samples were processed similarly to that for 2000 samples.

Tailings obtained from three slickens areas on the GRKO were delivered to the **ep** and **t** lab by Susan Kristoferson on 26 June 2001. An aliquot of each subsample was taken to determine pH. Subsequently, all tailings samples were mixed to yield one composite sample.

---

[4] See Moore and Woessner, 2001 and Gannon and Rillig, 2001 for description of the stratified random selection process. ArcView maps showing location of sampling sites are presented in Moore and Woessner, 2001.

[5] See Gannon and Rillig, 2002 for description of the stratified random selection process used to identify candidate sample locations. ArcView maps showing location of sampling sites are presented in Moore and Woessner, 2002.

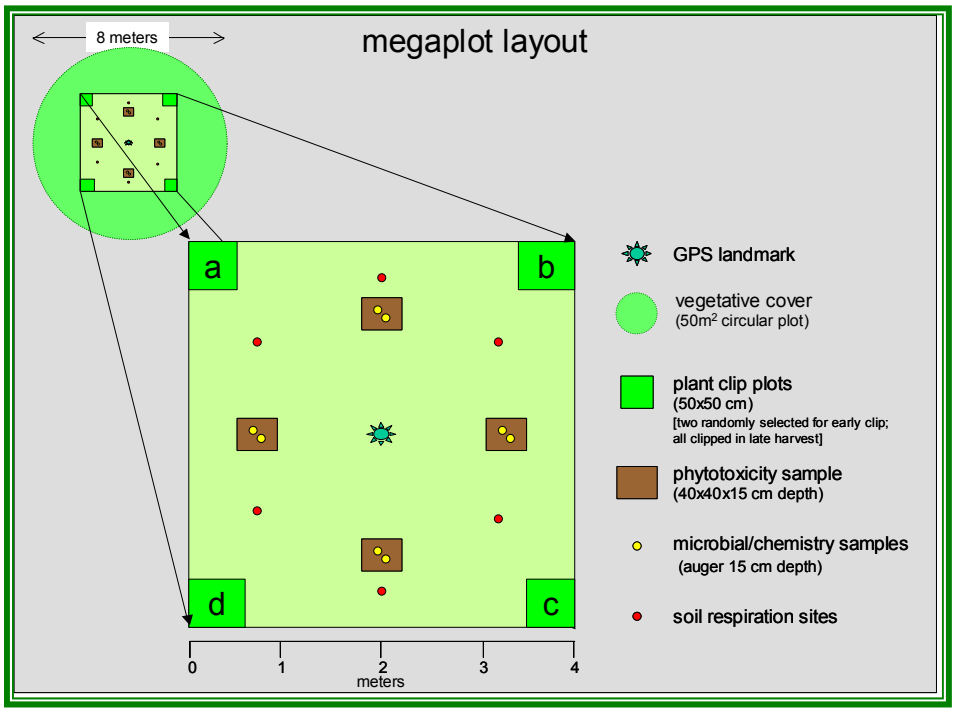


Figure 2. Layout of sample area for samples from 2001.

b) chemical analyses of soils used in tests

Analyses of soils used in standardized phytotoxicity tests were performed in Dr. Moore's laboratory, University of Montana, Missoula (See Moore and Woessner, 2001, 2002). Characterization of artificial soil and fill soil were performed by AgriCheck, Umatilla, OR.[6] Analyses of CoC of tailings used in laboratory tests and Clark Fork River sand used as fill soil in the field were performed by Mitkem, Providence, RI. All test soils had CoC concentrations substantially greater than controls or fill soils used in the studies (Table 1).

[6] The characterization of batch samples of artificial soil and a reference soil (Camas series) are from a previous study by **ep** and **t** for the US EPA Ecological Soil Screening (Eco-SSL) project.

Table 1. CoC ranges from test samples and soil characterization of controls and fill used in laboratory phytotoxicity tests.

CoC of soil samples used in standardized tests [a]					
statistics	**As (ppm)**	**Cu (ppm)**	**Z (ppm)**	**pH**	**O.C. (%)**
minimum	26	120	109	4.23	0.9
maximum	880	7100	2900	8.50	14.6
mean	315	2343	1487	7.50	4.4
median	290	2033	1400	7.10	3.6
CoC of control and fill soils [b]					
artificial	n.d.	n.d.	n.d.	5.01	5.0
riverine sand	4.0	14.1	31.4	6.32	0.1
CoC of tailings and Clark Fork River (CFR) fill soils [b]					
tailings	626	1,423	1,181		n.d.
CFR sand	5.3	24.7	30.1		n.d.

[a] Analysis performed by Dr. Moore's laboratory, University of Montana, Missoula

[b] Analyses, performed by Mitkem, Corporation, Providence, RI; pH was measured by **ep** and **t** staff.

c) test species

Seeds were purchased from commercial vendors for the laboratory studies (See Table 2). Alder, dogwood, and sedge seeds were pre-conditioned by Bitterroot Restoration to break dormancy prior to shipping to **ep** and **t**. We sprouted these seeds to obtain uniform numbers of plants at the start of the tests. The alfalfa seeds were pre-treated with a rhizobium inoculum, enabling scoring nodule formation as an additional endpoint. Series 2 alfalfa seeds and alder seedlings were purchased for the study. Alder, Bebb willow, and sedge seedlings were used in the field studies. Alfalfa, alder, Bebb willow, sedge, and wheat were used in the laboratory portions of the buried tailings studies.

Table 2. Source of seeds and seedlings used in tests.		
standardized tests in 2000		
common name:	alder	alfalfa var. Nitro Plus
binomial:	*Alnus incana*	*Medicago sativum*
supplier:	Bitterroot Restoration, Corvallis, MT	Territorial Seed Co., Cottage Grove, OR
lot number:	Seed: ALNINC 18 MT	Lot # 18041
collection site:	Deer Lodge County, MT, 5000' elev.	N/A
germination:	38%	87%
common name:	beaked sedge	red-osier dogwood
binomial:	*Carex utriculata*	*Cornus stolonifera*
supplier:	Bitterroot Restoration, Corvallis, MT	Bitterroot Restoration, Corvallis, MT
lot number:	CARUTR 24UT	CORSTO 31MT
collection site:	Wasatch County, UT 7000' elev.	Granite County, MT, 6000' elev.
germination:	84%	70%
standardized tests in 2001		
common name:	alder	alfalfa var. Nitro Plus
binomial:	*Alnus incana*	*Medicago sativum*
supplier:	Bitterroot Restoration, Corvallis, MT	Territorial Seed Co., Cottage Grove, OR
lot number:	ALNINC10T MO18MT0103	Lot # 18041
collection site:	Deer Lodge County, MT, 5000' elev.	N/A
germination:	N/A	87%
customized, buried tailings tests		
common name:	alder	alfalfa var. Nitro Plus
binomial:	*Alnus incana*	*Medicago sativum*
supplier:	Bitterroot Restoration, Corvallis, MT	Territorial Seed Co., Cottage Grove, OR
lot number:	ALNINC10T MO18MT010	Lot # 18041
collection site:	Deer Lodge County, MT, 5000' elev.	N/A
germination:	N/A	87%
common name:	beaked sedge plugs	Bebb's willow
binomial:	*Carex utriculata*	*Salix bebbiana*
supplier:	Bitterroot Restoration, Corvallis, MT	Bitterroot Restoration, Corvallis, MT
lot number:	CARUTR3T M024UT0007	SALBEB10T M00MT960
collection site:	Wasatch County, UT 7000' elev.	Ravalli County, MT 4000'elev.
germination:	N/A	N/A
common name:	wheat	
binomial:	*Triticum aestivum*	
supplier:	Territorial Seed Company, Cottage Grove, OR	
lot number:	WG4205/E	
collection site:	unknown	
germination:	not specified	

d) design for standardized phytotoxicity tests

The ASTM E1963-98 *Standard Guide for Conducting Plant Toxicity Tests Annex 1 Seedling Emergence* and *Annex 4 Woody Plant Species Growth and Development* (ASTM, 2000) was used for this project. This Guide provides descriptions of steps used in testing environmental (i.e., site) samples to determine phytotoxicity vis-à-vis reference samples. Plant performance was evaluated in comparison to endpoints measured using negative controls. The Guide also provides for a wide range of plant species that are suited for use in such tests. The duration of the test minimizes nutrient effects and therefore focuses on faster acting toxicity effects without the need to supplement the test soils with plant nutrients.

i) set-up procedures and measurement endpoints

Fifteen site soil samples were tested in 2000. Seventy-five pots (15 samples x 5 replicates) were prepared for alder and dogwood; 74 pots (14 samples x 5 replicates + 1 sample x 4 replicates) were prepared for alfalfa and sedge. Five replicate pots for each of three Positive Control concentrations (160-, 320-, and 640 ppm boron as boric acid[7]) and five replicate Negative Controls were prepared per species. Negative and Positive Controls used standard artificial soil consisting of sand (70%), kaolinite (20%), peat moss (10%), and calcium carbonate to achieve pH$\underline{\sim}$7 (~0.4%).

Thirty site soil samples were tested in 2001. One hundred and fifty pots (30 samples x 5 replicates) were prepared for alfalfa and alder. Five replicate pots for each of three Positive Control concentrations (160-, 320-, and 640 ppm boron as boric acid) for each species. Five replicate Negative Controls were prepared for alder and ten replicate Negative Controls were prepared for alfalfa. Negative and Positive Controls used standard artificial soil consisting of sand (70%), kaolinite (20%), peat moss (10%), and calcium carbonate to achieve pH$\underline{\sim}$7 (~0.4%).

The basic steps in the test involve:

- preparation of test matrix [natural soil or artificial soil (for negative controls)] in pots;
- introduction of seeds or seedlings into the test matrix;
- observation of emergence, general growth conditions, and survival over the test period; and
- quantitative measures of several plant growth parameters at the conclusion of the test.

We recorded qualitative information during the course of the tests. This included relative height of plants and appearance of the plants at emergence and at weekly intervals until harvest.

Qualitative observations of shoot height were recorded as relative to the reference (MT-00). General height of all plants in each replicate pot was noted as nominal or assigned to a quartile rank:

N .....nominal defined as $\underline{>}$90% of the reference;

-1.....75% to <90%;

-2.....50% to <75%;

-3.....25% to <50%; and

-4.....<25%.

[7] ASTM E-1963-98 suggests using boron as boric acid as the positive control agent.

Similarly, the appearance of shoots and roots were noted categorically:

N = normal color;

-1.....one or a few plants showing slight streaking, spotting, or yellowing;

-2.....one or a few plants showing obvious streaking, spotting, or yellowing;

-3.....most plants showing obvious streaking, spotting, or yellowing; and

-4.....most plants showing severe chlorosis or other discoloration.

Phytotoxicity may be expressed in one or more plant endpoints (Kapustka, 1997). The ASTM Guide recommends measurement of multiple endpoints. Quantitative data (counts, height or length, and mass;) as well as qualitative observations were gathered during and at the conclusion of the test (Table 3).

Table 3. Endpoints used to evaluate phytotoxicity.

Endpoint	Method	level
emergence	count	individual
day-7 post-emergence	count	individual
day-7 post-emergence shoot appearance	qualitative observations	replicate group (pot)
day-14 post-emergence [a]	count	individual
day-14 post-emergence shoot appearance [a]	qualitative observations	replicate group (pot)
day-21 post-emergence [b]	count	individual
day-21 post-emergence shoot appearance [b]	qualitative observations	replicate group (pot)
survival	count	individual
stem height	ruler	individual heights averaged for replicate group (pot)
root length (longest root)	ruler	individual lengths averaged for replicate group (pot)
shoot mass (wet and dry)	balance	replicate group (pot)
root mass (wet and dry)	balance	replicate group (pot)
total mass (wet and dry)	summed (shoot and root mass)	replicate group (pot)
total mass (dry) per plant	total mass/number of survivors	replicate group (pot)
nodule (alfalfa only)	count	individual

[a] For tests with in-life portions extending beyond 14 days.

[b] For tests with in-life portions extending beyond 21 days.

ii) test conditions

Generalized ranges of test conditions appropriate for the tests [e.g., $\geq$100 μmol m^{-2} s^{-1} photosynthetically active radiation (PAR); ambient temperatures between 20 C and 30 C] and descriptions of other factors important to the conduct of the test are detailed in the Guide.

Following receipt and processing of soils in 2000, the tests were initiated on 2 October 2000 (Table 4). The planting phase continued through 18 October 2000. Harvest began on 25 October 2000 and continued through 15 November 2000.

Following receipt and processing of soils in 2001, the tests were initiated on 5 June 2001 for alfalfa and on 9 July 2001 for alder. The planting phase for alfalfa continued though 13 June 2001. Alfalfa harvest began on 26 June 2001 and continued though 5 July 2001. The planting phase for alder continued though 12 July 2001. Harvest began on 13 August 2001 and continued though 16 August 2001.

Table 4. Phytotoxicity test dates and species tested

tests conducted in 2000			
Test Species		Start Dates	End Dates
Alder	*Alnus incana*	2 and 3 Oct, 2000	30 and 31 Oct, 2000
Alfalfa	*Medicago sativum*	11, 12, and 16 Oct, 2000	1, 2 and 6 Nov, 2000
Dogwood	*Cornus stolonifera*	9 and 18 Oct, 2000	6 and 15 Nov, 2000
Sedge	*Carex utriculata*	4 and 5 Oct, 2000	25 and 26 Oct, 2000
tests conducted in 2001			
Test Species		Start Dates	End Dates
Alder	*Alnus incana*	9, 10, 11 and 12 July, 2001	13, 14, 15 and 16 August, 2001
Alfalfa	*Medicago sativum*	5, 6,12 and 13 June, 2001	26, 27 June; 3, 5 July, 2001

The test room used for this study has dedicated controls for temperature, ventilation, and lighting. The target temperature was set at 22 C. A 16:8 (light:dark) photoperiod was used. Lighting was provided by Westinghouse Real Lite™, 48-inch fluorescent, 40 Watt, Full Spectrum bulbs (Domestic Code F40T12/FS). Light fluence rate was measured using a LiCor Sunfleck Quantum Sensor Model SF-80 during the test. The Guide recommends ambient temperatures between 20 C and 30 C and at least 100 μmol m^{-2} s^{-1} photosynthetically active radiation (PAR). Conditions during the test satisfied the guidelines (Table 5). Temperature excursions occurred in 2001 as noted in appendix 1, however, the magnitude and the extent of the excursions did not compromise the integrity of the tests.

Table 5. Environmental parameters of test room.				
Parameter	**Minimum**	**Maximum**	**Mean**	**Standard Deviation**
during standardized tests in 2000				
Temperature (C)	17.7	26.1	21.0	0.74
Relative Humidity (%)	32.0	63.0	44.9	6.90
Light fluence rate (μmol m^{-2} s^{-1})	140	189	166	14.6
during standardized tests in 2001				
Temperature (C)	18.9	25.1	22.2	0.74
Relative Humidity (%)	35.0	69.0	43.8	4.37
Light fluence rate (μmol m^{-2} s^{-1})	143	183	161	10
during customized tests on buried tailings in 2001				
Temperature (C)	20.3	26.3	21.9	0.25
Relative Humidity (%)	47.0	85.0	67.3	3.78
Light fluence rate (μmol m^{-2} s^{-1})	111	173	151	18.2
during customized slant-box tests on buried tailings in 2001				
Temperature (C)	18.7	31.7	22.5	1.02
Relative Humidity (%)	37.0	69.0	48.1	3.34
Light fluence rate (μmol m^{-2} s^{-1})	122	160	139	14.6

e) growth and re-growth of herbaceous vegetation in the field

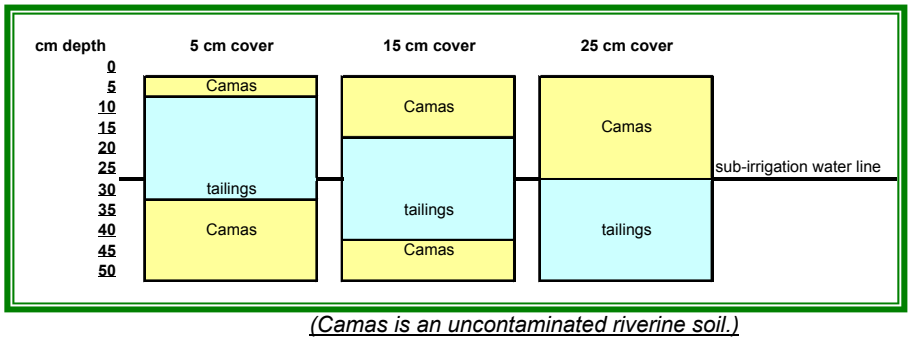
Two 0.5 m x 0.5 m = 0.25 m^2 plots in each of the 30 megaplots (see Figure 2) were selected randomly for collection of spring-time above-ground plant growth. The first harvest occurred between late-May and early-June 2001. All four plots in each megaplot were clipped late in the growing period (late-July to mid-August) to obtain measures of regrowth (from the previously clipped plots) and maximum standing crop from the two that were not clipped initially. Current year's growth was clipped at ground-level and sorted into forb and graminoid growth forms. Clipped plant material was transported to Missoula for drying. Oven dry weights were recorded. All field lab work on this portion of work was performed under the direction of Peter Rice, University of Montana, Missoula.

f) laboratory design for customized tests on effects of buried tailings

There were two components to the laboratory tests. These were designed to complement field studies conducted at approximately the same time.

i) set-up procedures and measurement endpoints

Laboratory tests using buried slickens were performed in 10 cm (4 inch) diameter PVC pipes cut to 50 cm length. Three treatments consisting of 5-cm, 15-cm, and 25-cm depth of clean soil laid over 25 cm of tailings were prepared; the base was filled with 20-cm, 10-cm and 0-cm clean soil respectively (Figure 3). Three replicates of each treatment depth were planted with alfalfa seeds (16 each), alder seedlings (one each), Bebb willow seedlings (one each), sedge plugs (one each), or wheat seeds (nine each; See Table 2). One set (three treatments, three replicates, five test species) was subjected to surface irrigation; another set was sub-irrigated.



(Camas is an uncontaminated riverine soil.)

Figure 3. schematic design of buried tailings laboratory experiments.

Slant-boxes (1 m long, 50 cm tall, 15 cm wide and tilted to proximately 15°) were constructed using clear Plexiglas sheets to enable *in situ* visualization of root growth in the laboratory. One set of slant boxes (one planted with alfalfa and one planted with wheat seeds) was irrigated from the surface; one set was sub-irrigated (Figure 4).

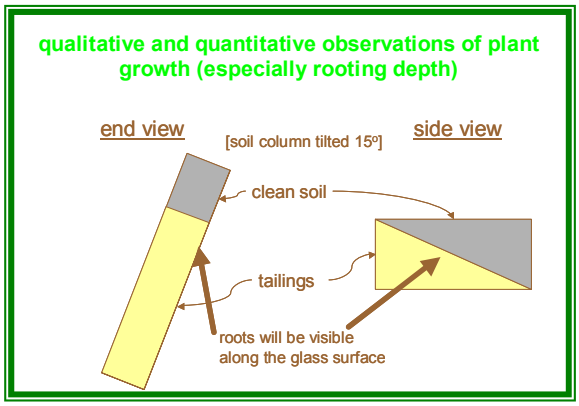


Figure 4. schematic design of slant-box studies.

At the start of the in-life portion of the tests, shoot height, leaf count, number of branches, and maximum root length were recorded. Weekly observations of shoot conditions were recorded for the customized tests on the effects of buried tailings. Weekly observations of both shoots and roots were made in the slant-box studies. Quantitative measures taken at the termination of the in-life portion of the tests included shoot height, leaf count, branch count, shoot mass, root length, and root mass.

ii) test conditions

See Table 5 above.

g) design for field studies of buried tailings

The field study was designed to complement two laboratory studies conducted at approximately the same time. Samples of tailings from three slickens areas were collected and shipped for use in the laboratory tests.

i) set-up procedures and measurement endpoints

Three slickens areas (near MP-071, MP-065, and MP-060) were selected as sites for installation of field plots. Five 1m x 1m surfaces devoid of vegetation and at nominally the same elevation and exposure conditions were marked within each site. The surficial slickens were removed from these 1m x 1m plots to depths of 5-, 10-, 15-, 20, or 25 cm (Figure 5). Plexiglas sidewalls and divider panels or corresponding depths were placed in each pit. Uncontaminated riverine sandy soil from the Clark Fork River basin was added as fill material at the corresponding depths.

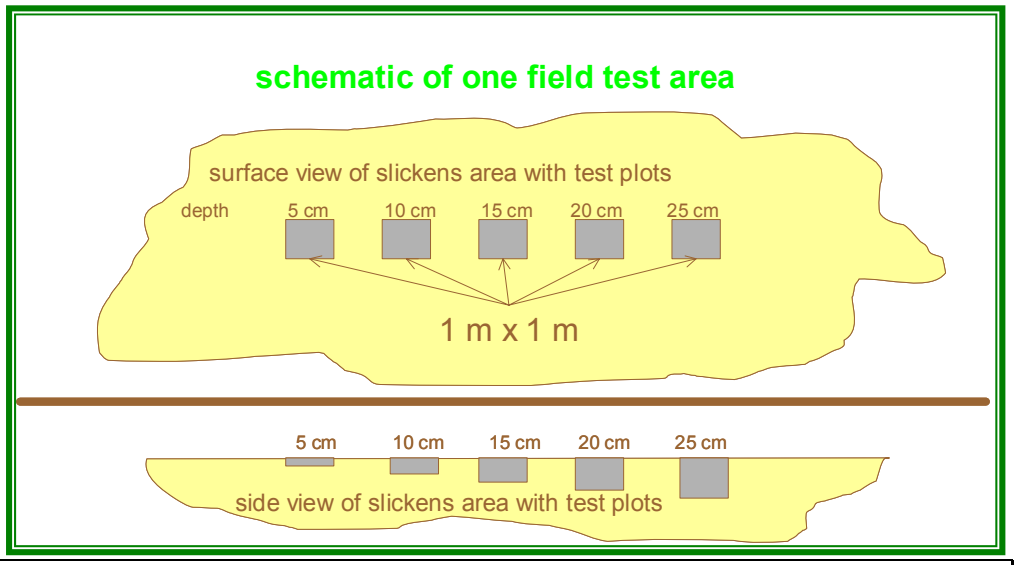


Figure 5. schematic design of buried tailings field studies.

Alder, willow, and sedge plants (ten each) were removed from Conetainers and planted in rows separated by divider panels in each plot.[8] Shoot height and number of branches were recorded for each individual. A tent made of fine-mesh plastic window screening was constructed over each plot to protect the plants from deer, rodents, and insects.

Plots were irrigated with Clark Fork River water immediately following planting. Watering continued on a daily basis for one week. During the second week, watering was reduced to every other day. During the third week, plots were watered twice. Thereafter, no irrigation water was added.

ii) test conditions

Dry, hot conditions prior to installation and planting of plots dictated the need to irrigate the plots at the start of the in-life portion of the tests to maximize survival of the alder, willow, and sedge plants. The high temperatures and low moisture conditions at the onset precluded emergence of alfalfa in the test plots. Irrigation of the plots the plots and substantial rainfall in mid-July altered one of the key conditions of the study design, namely the upward mobility and accumulation of toxic substances from the buried tailings into the uncontaminated fill. The later part of July and all of August were marked a return to high temperatures and low precipitation. In early September, nighttime

[8] Alfalfa was seeded in a divided area of each plot. However, high temperatures and rapid drying of the surface of the soils prevented emergence of nearly all alfalfa seedlings. Consequently, no data on alfalfa was obtained from these field studies.

temperatures reached freezing. By harvest time (late September), frosts had initiated leaf-fall of alder and especially willow plants.

h) statistical tests

Data were transcribed from paper data sheets into electronic format in a MicroSoft ACCESS® Database. All entries were crosschecked for accuracy. Data reports prepared in Access were saved as EXCEL® files. Data were handled in EXCEL® to perform various calculations, sorts, and compilations. The non-parametric means test (Kruskal-Wallis) was run using STATISTICA® (StatSoft, Inc., 1997). Regression Analyses were performed using both EXCEL® and STATISTICA®.

3) results and discussion

Tests in 2000 used alder, dogwood, and sedge seedlings germinated prior to planting into the test soils. Due to their relatively slower growth rate, the in-life portion of these tests was extended to 21 days (alder and sedge) and 28 days (dogwood). Alfalfa tests were run for 14-days post-emergence.

Tests in 2001 used alder planted as seedlings and alfalfa from seed. The in life portion of these tests ran 35 days for alder; alfalfa test were run for 21 days (nominally 14-days post-emergence).

Laboratory experiments on the phytotoxic effects of buried slickens extended over 44 days. Slant-box observations were made over the 42-day duration of tests. These were followed by quantitative measures of shoot and root endpoints.

Field observations of effects of buried slickens were made over the 13-week duration of the study. Harvest data consisting of shoot and root endpoints were taken following 95 days of the study.

Digital photographs were taken periodically during the laboratory tests. A limited number of illustrative photos are presented in appendix 4.

a) narrative descriptions for standardized phytotoxicity tests

Growth in Negative and Positive Controls followed nominal patterns during the course of the study. For purposes of describing the results of these tests, comparisons were made to the corresponding endpoints measured in the respective Negative Controls.

Sample MT-01: [equivalent to MP-082] Plant growth for MT-01 was varied across the different species. Overall, plant growth for alder and sedge was inhibited compared to negative controls. Plant growth for alfalfa and dogwood was nominal or stimulated compared to the negative controls with one exception, alfalfa root dry weights. Shoot dry weights for both alder and especially the sedge were lower compared to controls and shoot dry weights for alfalfa and dogwood were higher. Root dry weights for alder, sedge, and alfalfa were lower compared to negative controls and dogwood was the same compared to negative controls. Root lengths in both alder and alfalfa were longer compared to negative controls however the root dry weights for alder and notably alfalfa were lower compared to negative controls. Alder and sedge exhibited shoot discoloration on most plants and changes in root appearance in some plants at harvest. Alfalfa and dogwood color and appearance at harvest were nominal. Alfalfa nodule formation was nominal.

Sample MT-02: [equivalent to MP-067] Plant growth for MT-02 for all four species was inhibited compared to negative controls with sedge showing greatest sensitivity and alder showing the least sensitivity. All species, except alder, exhibited reduced height growth and shoot discoloration in some plants by week-2 (7-day post emergence for alfalfa). By harvest time, the alder demonstrated some shoot discoloration. All dry weights were inhibited as compared to negative controls with alfalfa and especially sedge demonstrating greatest sensitivity. Inhibited growth also seemed to be more severe in the roots as compared to the shoots for all species when compared to negative controls. Alfalfa nodule formation was severely inhibited.

Sample MT-03: [equivalent to MP-099] Plant growth for MT-03 for all species, except dogwood, was inhibited as compared to negative controls. Dogwood growth appeared to be inhibited early in the experiment, but approached nominal at the end of the test. Shoot heights for all species except sedge were nominal at the end of the test and the dry weights were inhibited. Root lengths for all species were stimulated compared to negative controls. The root dry weights were all inhibited compared to the negative controls. Shoot and root color and appearances at harvest were generally nominal with the exception of alder that exhibited discoloration and changes in appearance for roots and shoots in some plants. Plant mortality in alder was high. Alfalfa nodule formation was moderately inhibited.

Sample MT-04: [equivalent to MP-098] Plant growth for MT-04 for all species was stimulated, except for alder, which was nominal to slightly inhibited compared to negative controls. Total dry weights were higher compared to the negative controls except for alder, which was nominal. Exceptions to the stimulatory response occurred in the root dry weights for alder, alfalfa, and slightly with sedge and shorter root length in sedge. Shoot and root color and appearances at harvest were generally nominal with the exception of alder that exhibited discoloration and changes in appearance for roots and shoots in some plants and sedge, which exhibited an altered root appearance. Alfalfa nodule formation was moderately inhibited.

Sample MT-05: [equivalent to MP-018] Plant growth for MT-05 for all four species was inhibited compared to negative controls with sedge showing greatest sensitivity and alfalfa showing the least sensitivity (yet still significantly affected). All species displayed inhibited height growth and shoot discoloration in some plants by week-2 (7-day post emergence for alfalfa). Plant mortality in alder was high. Both shoot and root dry weights were low compared to negative controls with all species. Most plants demonstrated shoot discoloration and some plants displayed changes in shoot appearance by harvest. Most plants demonstrated changes in root appearance. Some plants displayed discolored roots. Alfalfa nodule formation was severely inhibited.

Sample MT-06: [equivalent to MP-000] Plant growth for MT-06 for all four species resulted in complete mortality by week 1 for all species except a few alders, which succumbed, by week 2. Bluish-green crystals were noted on the higher places on the surface of all MT-06 pots. The crystals appeared to be the result of evaporative processes. Note that all pots were sub-irrigated.

Sample MT-07: [equivalent to MP-061] Plant growth for MT-07 was inhibited for all four species with sedge displaying the greatest sensitivity and dogwood the least sensitivity compared to the negative controls. All species had inhibited height growth and shoot discoloration in some plants by week-2 (7-day post emergence for alfalfa). Plant mortality in alder was high. Both shoot and root dry weights were low compared to negative controls for all species except for dogwood, which was only slightly lower. Some plants demonstrated shoot discoloration along with changes in shoot appearance at harvest. Some plants demonstrated changes in root appearance and discoloration at harvest. Alfalfa nodule formation was highly inhibited.

Sample MT-08: [equivalent to MP-058] Plant growth for MT-08 was inhibited for all four species with sedge showing the greatest sensitivity and dogwood the least sensitivity (yet still significantly affected) compared to the negative controls. All species displayed inhibited height growth and shoot discoloration in some plants by week-2 (7-day post emergence for alfalfa). Both shoot and root dry weights were low compared to negative controls for all species. Most plants displayed shoot discoloration and altered shoot appearance at harvest, especially alder and dogwood. Most plants displayed root discoloration and all plants demonstrated altered root appearance at harvest, especially alder and dogwood. Alfalfa nodule formation was severely inhibited.

Sample MT-09: [equivalent to MP-0692] Plant growth for MT-09 was inhibited for all four species with sedge showing the greatest sensitivity and dogwood the least sensitivity. All species displayed inhibited height growth and shoot discoloration in some plants by week-2 (7-day post emergence for alfalfa). Both shoot and root dry weights were low compared to negative controls with all species. Most plants demonstrated shoot discoloration at harvest. Some plants demonstrated changes in shoot appearance and root discoloration at harvest in all species except sedge. Some plants

demonstrated changes in root appearance at harvest, especially alder. Alfalfa nodule formation was highly inhibited.

Sample MT-10: [equivalent to MP-07] In MT-10 mortality occurred among all replicates of alfalfa and dogwood by week 1; all plants for all species except had died by week-2. Bluish-green crystals were noted on the higher places on the surface of all MT-10 pots. The crystals appeared to be the result of evaporative processes. Note that all pots were sub-irrigated.

Sample MT-11: [equivalent to MP-051] Plant growth for MT-11 was inhibited for all four species with sedge showing the greatest sensitivity and dogwood the least sensitivity compared to negative controls. All species displayed inhibited height growth and shoot discoloration in some plants by week 2 (7-day post emergence for alfalfa). Shoot and root dry weights were especially low in the alfalfa and sedge. Shoot and root dry weights for alder was slightly inhibited and dry weights for dogwoods were nominal to slightly stimulated. Root lengths for all species were inhibited. Most plants demonstrated shoot discoloration at harvest. Some plants demonstrated changes in shoot appearance and root discoloration at harvest. Most plants demonstrated changes in root appearance at harvest, especially apparent in alder and sedge. Alfalfa nodule formation was severely inhibited.

Sample MT-12: [equivalent to MP-054] Plant growth for MT-12 was inhibited for all species except dogwood, which was slightly stimulated as compared to the negative controls. Sedge was the most sensitive followed by alfalfa then alder. Most plants in sedge and alfalfa displayed inhibited height growth and shoot discoloration in some plants by week-2 (7-day post emergence for alfalfa). Total dry weights were especially low in the alfalfa and sedge. Some plants in all species displayed shoot discoloration and altered shoot appearance at harvest. A few plants demonstrated some root discoloration in all species except sedge at harvest. Some plants in alder and dogwood demonstrated changes in root appearance and most plants in alfalfa and sedge displayed changes in root appearance at harvest. Alfalfa nodule formation was highly inhibited.

Sample MT-13: [equivalent to MP-035] Plant growth for MT-13 was inhibited for all species except dogwood, which had slightly stimulated total dry weights, as compared to the negative controls. Sedge was the most sensitive followed by alder then alfalfa. All species displayed inhibited height growth and shoot discoloration in some plants by week-2 (7-day post emergence for alfalfa) except alder, which displayed no discoloration. Total dry weights were especially low in the alder and sedge. Most plants in all species displayed shoot discoloration. Some plants in all species demonstrated altered shoot appearance except for sedge at harvest. Some plants demonstrated root discoloration at harvest in all species except alder, which demonstrated root discoloration in most plants. With the exception of dogwood, all plants demonstrated changes in root appearance at harvest. Alfalfa nodule formation was severely inhibited.

Sample MT-14: [equivalent to MP-033] Plant growth endpoints for MT-14 were varied for all species except dogwood, which was generally stimulated as compared to the negative controls. Sedge demonstrated high inhibition especially regarding total dry weight. All species except alder displayed inhibited height growth in some plants by week-2 (7-day post emergence for alfalfa). Root lengths were stimulated in all species but sedge. Shoot heights were stimulated in alfalfa and dogwood, slightly inhibited in alder and inhibited in sedge and shoot dry weights reflected this. Harvest shoot and root color and appearances for alfalfa and dogwood were nominal. Alder and sedge demonstrated both shoot and root discoloration and changes in appearance at harvest in most plants with the exception of sedge shoot appearance and root discoloration, which was nominal. Alfalfa nodule formation was moderately inhibited.

Sample MT-15: [equivalent to MP-036] Plant growth for MT-2 for all four species was inhibited compared to negative controls with sedge and alfalfa showing greatest sensitivity and dogwood showing the least sensitivity (yet still significantly affected). All species displayed inhibited height growth and shoot discoloration in some plants by week-2 (7-day post emergence for alfalfa). Both shoot and root dry weights as well as shoot heights and root lengths were low compared to negative controls for all species. Most plants in all species demonstrated both shoot and root discoloration and changes in appearance at harvest. Alfalfa nodule formation was severely inhibited.

Sample MP-018: Plant growth for MP-018 was varied between species with alfalfa showing greater sensitivity. Mean count for alfalfa was nominal. Alfalfa shoot height and root length were slightly inhibited. Alfalfa shoot dry weight, root dry weight, total dry weight, and total dry weight per plant were moderately inhibited. Alfalfa nodule numbers were severely inhibited. Alder survival, shoot appearance, root color, root appearance, net leaf number, and net shoot height were nominal. Alder shoot color and net branch numbers were slightly inhibited. Alder total dry weight was moderately inhibited and net root length was highly stimulated.

Sample MP-019: Plant growth for MP-019 was varied between species with alfalfa showing greater sensitivity. Alfalfa mean was slightly stimulated. Alfalfa root length was nominal. Alfalfa shoot height, shoot dry weight, and total dry weight were slightly inhibited. Alfalfa nodule number, root dry weight and total dry weight per plant were moderately inhibited. Alder survival, shoot color, shoot appearance, root color, and root appearance were nominal. Alder net leaf number and net shoot height were slightly stimulated. Alder total dry weight was slightly inhibited. Alder net branch number was severely inhibited and alder net root length was very highly stimulated.

Sample MP-021: Plant growth for MP-021 was varied between species with alfalfa showing greater sensitivity. Alfalfa mean count was slightly stimulated. Alfalfa shoot height, shoot dry weight, and root length were moderately inhibited. Alfalfa root dry weight, total dry weight, and total dry weight per plant were highly inhibited. Alfalfa nodule numbers were severely inhibited. Alder net branch number and net root length were very highly stimulated. Alder net shoot height was slightly stimulated. Alder survival, shoot color, shoot appearance, root color, root appearance, net leaf number and total dry weight were nominal.

Sample MP-022: Plant growth for MP-022 Plant growth for MP-021 was varied between species with alfalfa showing greater sensitivity. Alfalfa mean counts were slightly stimulated. Alfalfa shoot height, shoot dry weight, root length, and total dry weight were slightly inhibited. Alfalfa root dry weight and total dry weight per plant were moderately inhibited. Alfalfa nodule number was severely inhibited. Alder net root length was very highly stimulated. Alder net branch number was moderately stimulated. Alder survival, shoot color, shoot appearance, root color, root appearance, net leaf number and net shoot height were nominal. Alder total dry weight was slightly inhibited.

Sample MP-024: Plant growth for MP-024 was varied between species with alfalfa showing greater sensitivity. Alfalfa mean counts were moderately stimulated. Alfalfa root length was slightly inhibited. Alfalfa was slightly inhibited. Alfalfa shoot height, shoot dry weight, root dry weight, total dry weight were moderately inhibited. Alfalfa total dry weight was highly inhibited. Alfalfa nodule number was severely inhibited. Alder net branch number and net root length were very highly stimulated. Alder survival, shoot color, shoot appearance, root color, root appearance, and net leaf number were nominal. Alder net shoot height and total dry weights were slightly inhibited.

Sample MP-033: Plant response for most endpoints in MP-033 tests was nominal or stimulated for both species except for alder total dry weight and alfalfa nodule count. Alfalfa mean count, shoot height, shoot dry weight and total dry weight were slightly stimulated. Alfalfa root dry weight, root length and total dry weight per plant were nominal. Alfalfa nodule number was moderately inhibited. Alder net root length was very highly stimulated. Alder net leaf number and net shoot height were slightly stimulated. Alder survival, shoot color, shoot appearance, root color, root appearance and net branch number were nominal. Alder total dry weight was moderately inhibited.

Sample MP-034: Plant growth for MP-034 was varied between species with alfalfa showing greater sensitivity. Alfalfa mean counts were slightly stimulated. Alfalfa root length was slightly inhibited. Alfalfa shoot height, shoot dry weight, root dry weight, total dry weight, and total dry weight per plant were moderately inhibited. Alfalfa nodule count was highly inhibited. Alder net leaf number, net branch number and net root lengths were highly to very highly stimulated. Alder survival, shoot color, shoot appearance and root color were nominal. Alder root appearance, net shoot height, and total dry weight were slightly inhibited.

Sample MP-035: Plant growth for MP-035 was severely inhibited for both alfalfa and alder. All endpoints for alfalfa were severely inhibited with over 90% mortality. All endpoints for alder were severely inhibited except for survival, which was slightly inhibited, and root color, which was nominal.

Sample MP-036: Plant growth for MP-036 was varied between species with alfalfa showing greater sensitivity. Alfalfa mean counts were nominal. Alfalfa shoot height, dry shoot weight, root length, root dry weight, total dry weight, and total dry weight per plant were moderately inhibited. Alfalfa nodule number was severely inhibited. Alder net root length was very highly stimulated and net branch number was highly stimulated. Alder survival, root color, root appearance, net leaf number and net shoot height were nominal. Alder shoot appearance was slightly inhibited. Alder shoot color and total dry weight was moderately inhibited.

Sample MP-042: Plant growth for MP-042 was varied between species with alfalfa showing greater sensitivity. Alfalfa mean counts were slightly stimulated. Alfalfa shoot height and dry shoot weight were moderately inhibited. Alfalfa root length, root dry weight, total dry weight, and total dry weight per plant were highly inhibited. Alfalfa nodule number was severely inhibited. Alder net root length was very highly stimulated. Alder net branch number and net shoot height were moderately stimulated. Alder survival, shoot color, shoot appearance, root color, root appearance and net leaf number were nominal. Alder total dry weight was highly inhibited.

Sample MP-051: Plant growth for MP-051 was highly inhibited for both alfalfa and alder. Alfalfa mean counts were nominal. All other alfalfa endpoints were severely inhibited. Alder survival and root color were nominal. Alder shoot appearance was moderately inhibited. Alder shoot color, root appearance and total dry weight were highly inhibited. Alder net leaf number, net branch number, net shoot height and net root length were severely inhibited.

Sample MP-053: Plant growth for MP-053 was highly inhibited for both alfalfa and alder. All alfalfa endpoints were severely inhibited with over 85% mortality. Alder survival and root color were nominal. Alder shoot appearance was moderately inhibited. Alder shoot color and root appearance and total dry weight were highly inhibited. Alder net leaf number, net branch number, net shoot height and net root length were severely inhibited.

Sample MP-056: Overall, plant growth for MP-056 was inhibited for both alfalfa and alder with alfalfa showing greater sensitivity. Alfalfa mean counts were slightly stimulated. Alfalfa shoot height, shoot dry weight and total dry weight and total dry weight per plant were highly inhibited. Alfalfa nodule number, root length, and root dry weights were severely inhibited. Alder survival, shoot appearance and root color were nominal. Alder shoot color and root appearance was slightly inhibited. Alder net leaf number, net root length and total dry weight were moderately inhibited. Alder net branch number and net shoot height were highly inhibited.

Sample MP-057: Overall, plant growth for MP-057 was inhibited for both alfalfa and alder with alfalfa showing greater sensitivity. Alfalfa mean counts were nominal. Alfalfa shoot height was moderately inhibited. Alfalfa shoot dry weight, root length, root dry weight, total dry weight, and total dry weight per plant were highly inhibited. Alfalfa nodule number was severely inhibited. Alder net root length was very highly stimulated. Alder net leaf number was moderately stimulated. Alder survival, root color and root appearance were nominal. Alder shoot color, shoot appearance, net shoot height and total dry weight were moderately inhibited. Alder net branch number was severely inhibited.

Sample MP-058: Overall, plant growth for MP-058 was inhibited for both alfalfa and alder with alfalfa showing greater sensitivity. Alfalfa mean counts were nominal. Alfalfa shoot height, shoot dry weight, root length, total dry weight, and total dry weight per plant were highly inhibited. Alfalfa nodule number and root dry weight were severely inhibited. Alder survival, shoot appearance, root color, net leaf number, and net root length were nominal. Alder shoot color and root appearances were slightly inhibited. Alder total dry weight was moderately inhibited. Alder net branch number and net shoot height were severely inhibited.

Sample MP-059: Overall, plant growth for MP-059 was inhibited for both alfalfa and alder with alfalfa showing greater sensitivity. Alfalfa mean count was nominal. Alfalfa shoot height, shoot dry weight, root length, root dry weight, total dry weight and total dry weight per plant were highly inhibited. Alfalfa nodule number was severely inhibited. Alder survival, root color, and net leaf number were nominal. Alder shoot appearance, root appearance and net branch number were all slightly inhibited. Alder shoot color, net shoot height and total dry weight were moderately inhibited. Alder net shoot height was highly inhibited.

Sample MP-060: Overall, plant growth for MP-060 was inhibited for both alfalfa and alder with alfalfa showing greater sensitivity. Alfalfa mean counts were slightly inhibited. All other alfalfa endpoints were severely inhibited. Alder survival and root color were nominal. Alder shoot appearance was slightly inhibited. Alder shoot color, root color, and net leaf numbers were moderately inhibited. Alder total dry weight was highly inhibited. Alder net branch number, net shoot height and net root length were severely inhibited.

Sample MP-062: Overall, plant growth for MP-062 was inhibited for both alfalfa and alder with alfalfa showing greater sensitivity. Alfalfa mean counts were nominal. Alfalfa shoot height, shoot dry weight, root length, and total dry weight per plant were highly inhibited. Alfalfa nodule number, root dry weight, and total dry weight were severely inhibited. Alder survival, root color and net root length were nominal. Alder shoot appearance was slightly inhibited. Alder shoot color, root appearance and net leaf numbers were moderately inhibited. Alder total dry weight was highly inhibited. Alder net branch number and net shoot height were severely inhibited.

Sample MP-065: Plant growth for MP-065 was varied between species with alfalfa showing greater sensitivity. Alfalfa mean count and root length were nominal. Alfalfa shoot height and shoot dry weight were slightly inhibited. Alfalfa root dry weight, total dry weight, and total dry weight per plant were moderately inhibited. Alfalfa nodule number was severely inhibited. Alder net root length was very highly stimulated. Alder net leaf number was highly stimulated. Alder survival, shoot color, shoot appearance, root color, root appearance, net shoot height and total dry weight were nominal. Alder net branch number was slightly inhibited.

Sample MP-066: Plant growth for MP-066 was severely inhibited for both alfalfa and alder and resulted in 100% mortality for both species.

Sample MP-067: Overall plant growth for MP-067 was inhibited for both alfalfa and alder with alfalfa showing greater sensitivity. Alfalfa mean counts were nominal. Alfalfa shoot height was slightly inhibited. Alfalfa shoot dry weight, root length, total dry weight, and total dry weight per plant were moderately inhibited. Alfalfa root dry weight was highly inhibited. Alfalfa nodule number was severely inhibited. Alder net root length was very highly stimulated. Alder net leaf number was moderately stimulated. Alder survival, shoot color, shoot appearance, root color and root appearance were nominal. Alder net shoot height and total dry weights were moderately inhibited. Alder net branch number was severely inhibited.

Sample MP-068: Overall plant growth for MP-068 was inhibited for both alfalfa and alder with alfalfa showing greater sensitivity. Alfalfa mean counts were nominal. Alfalfa shoot height was slightly inhibited. Alfalfa shoot dry weight, root length, total dry weight, and total dry weight per plant were moderately inhibited. Alfalfa root dry weight was highly inhibited. Alfalfa nodule number was severely inhibited. Alder net root length was moderately stimulated. Alder survival, shoot color, shoot appearance, root color and root appearance were nominal. Alder net leaf number and total dry weights were slightly inhibited. Alder net shoot height was moderately inhibited. Alder net branch number was severely inhibited.

Sample MP-069: Overall plant growth for MP-069 was inhibited for both alfalfa and alder with alfalfa showing greater sensitivity. Alfalfa mean counts were nominal. Alfalfa shoot height and root length were moderately inhibited. Alfalfa shoot dry weight, root dry weight, total dry weight, and total dry weight per plant were highly inhibited. Alfalfa nodule number was severely inhibited. Alder net root length was highly stimulated. Alder net leaf number was slightly stimulated. Alder survival, root color

and root appearance were nominal. Alder shoot appearance and net branch numbers were slightly inhibited. Alder shoot color, net shoot height and total dry weights were moderately inhibited.

Sample MP-070: Overall plant growth for MP-070 was inhibited for both alfalfa and alder with alfalfa showing greater sensitivity. Alfalfa mean counts were slightly inhibited. All other endpoints were severely inhibited. Alder survival and root color was nominal. Alder shoot color, shoot appearance, root appearance and net leaf number were moderately inhibited. Alder net branch number and total dry weights were highly inhibited. Alder net shoot height and net root length was severely inhibited.

Sample MP-071: Plant growth for MP-071 was severely inhibited for both alfalfa and alder and resulted in 100% mortality for both species.

Sample MP-072: Overall plant growth for MP-072 was inhibited for both alfalfa and alder. Alfalfa mean counts were nominal. Alfalfa shoot height, shoot dry weight, and root length were slightly inhibited. Alfalfa root dry weight, total dry weight, and total dry weight per plant were moderately inhibited. Alfalfa nodule number was severely inhibited. Alder net root length was slightly stimulated. Alder survival, shoot color, shoot appearance, root color, root appearance, and net leaf number were nominal. Alder net shoot height and total dry weights were moderately inhibited. Alder net branch number was highly inhibited.

Sample MP-077: Overall plant growth for MP-077 was inhibited for both alfalfa and alder. Alfalfa mean counts were nominal. Alfalfa shoot height and shoot dry weight were slightly inhibited. Alfalfa root length, root dry weight, total dry weight, and total dry weight per plant were moderately inhibited. Alfalfa nodule number was severely inhibited. Alder net leaf number was moderately stimulated. Alder survival, shoot appearance, root color, root appearance and net shoot height were nominal. Alder shoot color was moderately inhibited. Alder total dry weight was highly inhibited. Alder net branch number and net root length were severely inhibited.

Sample MP-078: Overall plant growth for MP-078 was inhibited for both alfalfa and alder. Alfalfa mean counts were nominal. Alfalfa shoot height and root length were moderately inhibited. Alfalfa shoot dry weight, root dry weight, total dry weight, and total dry weight per plant were highly inhibited. Alfalfa nodule number was severely inhibited. Alder net shoot height and net root length was slightly stimulated. Alder survival, shoot appearance, root color, root appearance, and net leaf number were nominal. Alder shoot color was slightly inhibited. Alder total dry weight was moderately inhibited. Alder net branch number was highly inhibited.

Sample MP-079: Overall plant growth for MP-079 was inhibited for both alfalfa and alder. Alfalfa mean counts were nominal. Alfalfa shoot height, shoot dry weight, and total dry weight per plant were highly inhibited. Alfalfa root length, root dry weight, total dry weight, and nodule number were severely inhibited. Alder survival, root color and net branch number was nominal. Alder shoot color, shoot appearance, root appearance and net leaf number were moderately inhibited. Alder total dry weight was highly inhibited. Alder net shoot height and net root lengths were severely inhibited.

Sample MP-100: Plant growth for MP-100 was varied between species with alfalfa showing greater sensitivity. Alfalfa nodule numbers were very highly stimulated. Alfalfa mean counts, shoot height, and root length were slightly inhibited. Alfalfa shoot dry weight, total dry weight, and total dry weight per plant were moderately inhibited. Alfalfa root dry weight was highly inhibited. Alder net root length was highly stimulated. Alder survival, shoot color, shoot appearance, root color, root appearance, net leaf number and net shoot height were nominal. Alder total dry weight was moderately inhibited. Alder net branch number was highly inhibited.

b) quantitative summaries from standardized phytotoxicity tests

Measurements of plant performance were analyzed using non-parametric statistical tests (e.g., Kruskal-Wallis) to ascertain significant differences among treatments (Kapustka *et al*., 1995). Phytotoxicity may be expressed in one or more plant endpoints (Kapustka, 1997). The ASTM Guide recommends measurement of multiple endpoints.

To gain an overview of the large quantity of data, we developed a method to rank degrees of plant response following the approach described in Kapustka, *et al*. (1995). This method provides a means of indexing the degree of responsiveness of each endpoint for each soil sample relative to reference samples. The replicate values for each species-endpoints for each soil were compared to the respective values of the reference sample replicates. If the species endpoint for a sample was statistically less than the reference (using the nonparametric Kruskal-Wallis means test) and the endpoint was ≤90% of the reference, it was considered to identified as a phytotoxic response. Those species-endpoint data that were not statistically different from the reference values or were within 90% of the reference value were listed as *non-phytotoxic*. Four categories of plant response were scored according to the magnitude of reduction. For example, if a sample was determined to be significantly different from the reference and >75% of the controls, it was designated as *mildly phytotoxic*; if the endpoint was statistically different from reference and was between 51% and 75% of the reference it was designated as *moderately phytotoxic*; if statistically different and between 26% and 50% of reference it was designated as *highly phytotoxic*; and if significantly different and ≤25% of reference, it was designated as *severely phytotoxic*. Numerical scores were assigned to each category: 0 for non-phytotoxic, 0.5, 1, 2, and 4 for the different levels of plant response (mild, moderate, high, and severe respectively). The rank scores (0, 0.5, 1, 2, or 4) were summed for all species-endpoints to give a sample site score.[9] Though data from series 1 and series 2 tests had to be analyzed separately with their respective controls, once the data were transformed into phytotoxicity scores, the data could be combined for common analyses.

Eight of the 30 sampling sites in 2001 were located within 5 m of 2000 sampling sites. CoC concentrations of these eight sample pairs underscore the magnitude of spatial heterogeneity of CoC distribution within the riparian zone. Arsenic (R^2 = 0.5563) and to a lesser extent Zn (R^2 = 0.2230) were correlated between paired samples, however, Cu (R^2 = 0.0499) and pH (R^2 = 0.0279) were markedly different between paired samples. The variability is reflected further in the phytotoxic response as measured by alfalfa growth per plant (R^2 = 0.0560). Therefore, each of these samples was considered unique and retained in the subsequent analyses.

Three of the samples from 2000 (MT-01, MT-03, and MT-04) were identified as non-riparian sites. Also, Dr. Gannon's group identified anomalies in soil characteristics and microbial measures in sample MT-09. Data from these four sites were eliminated from the Kruskal-Wallis tests and regression analyses. Of the 30 samples in 2001, five were anomalous in terms of high organic matter (MP-018, MP-024, MP-056, MP-062, and MP-065) and high pH (MP-079). High organic matter is known to have marked effects on phytotoxic responses to metals. High pH also markedly alters phytotoxic properties of As. Consequently, for purposes of interpreting patterns of response, regression analyses were performed with all data as well as with the data from these selected samples removed from the analyses.

The endpoints that showed the greatest phytotoxic response were mean nodule number (in alfalfa), root dry weight, total dry weight per pot, and total dry weight per plant (Table 6). The endpoints that showed the least phytotoxic response were the early (i.e., first or second week) shoot appearance and color.

Phytotoxicity scores also were used to classify the magnitude of phytotoxicity observed for the 45 soils (Table 7). Soil samples MT-01 through MT-15 were tested with four species (alfalfa, alder, dogwood, and sedge); soil samples MP-18 through MP-100 were tested with two species (alfalfa and alder). The compiled results demonstrate that seven samples were severely phytotoxic, 12 were highly phytotoxic, 18 were moderately phytotoxic, and six were mildly phytotoxic, and two were scored as non-phytotoxic.

---

[9] Information from data summaries statistics (*p*-values) and relative differences from Negative Controls were used to calculate phytotoxicity scores (appendix 3).

Table 6. Rank of endpoints responsiveness as calculated using mean phytotoxicity scores across four test species.

Endpoint [a]	Phytotoxicity Score [b]	Endpoint [a]	Phytotoxicity Score [b]
Mean Nodule Number	3.20	Mean Root Length (mm)	0.91
Mean Net Growth - Leaf Number [c]	2.53	Mean Shoot Height (mm)	0.87
Root Dry Weight (g)	2.42	PE 14 Shoot Appearance	0.87
Total Dry Weight (g)	1.78	PE 14 Count	0.83
Root Appearance	1.73	Shoot Appearance	0.72
Shoot Dry Weight (g)	1.72	PE 14 Shoot Color	0.60
Total Dry Weight per Plant (g)	1.60	PE 7 Shoot Color	0.58
PE 7 Height	1.33	PE 7 Shoot Appearance	0.40
Shoot Color	1.27	Harvest Count	0.38
PE 14 Height	0.93	PE 7 Count	0.36
Root Color	0.91	Emergence Count	0.23

[a] PE = Post-emergence. [b] Phytotoxicity Scores are unitless values between 0 and 4 (See text).
[c] applicable only to buried tailings laboratory tests with seedlings.

Table 7. Phytotoxicity scores compiled for tests by soil sample.

Sample ID	Phytotoxicity Category	Phytotoxicity Score	Sample ID	Phytotoxicity Category	Phytotoxicity Score
MT-01	Mildly Phytotoxic	0.45	MP-036	Moderately Phytotoxic	0.57
MT-02	Moderately Phytotoxic	0.90	MP-042	Moderately Phytotoxic	0.70
MT-03	Mildly Phytotoxic	0.42	MP-051	Severely Phytotoxic	2.03
MT-04	Mildly Phytotoxic	0.18	MP-053	Severely Phytotoxic	2.03
MT-05	Highly Phytotoxic	1.33	MP-056	Highly Phytotoxic	1.45
MT-06	Severely Phytotoxic	3.53	MP-057	Moderately Phytotoxic	0.95
MT-07	Moderately Phytotoxic	0.74	MP-058	Highly Phytotoxic	1.31
MT-08	Highly Phytotoxic	1.06	MP-059	Highly Phytotoxic	1.13
MT-09	Moderately Phytotoxic	0.85	MP-060	Highly Phytotoxic	1.83
MT-10	Severely Phytotoxic	3.21	MP-062	Highly Phytotoxic	1.40
MT-11	Highly Phytotoxic	1.09	MP-065	Mildly Phytotoxic	0.36
MT-12	Moderately Phytotoxic	0.82	MP-066	Severely Phytotoxic	2.29
MT-13	Highly Phytotoxic	1.17	MP-067	Moderately Phytotoxic	0.69
MT-14	Moderately Phytotoxic	0.52	MP-068	Moderately Phytotoxic	0.62
MT-15	Highly Phytotoxic	1.19	MP-069	Moderately Phytotoxic	0.74
MP-018	Moderately Phytotoxic	0.54	MP-070	Highly Phytotoxic	1.90
MP-019	Mildly Phytotoxic	0.45	MP-071	Severely Phytotoxic	2.29
MP-021	Moderately Phytotoxic	0.65	MP-072	Moderately Phytotoxic	0.59
MP-022	Mildly Phytotoxic	0.34	MP-077	Moderately Phytotoxic	0.77
MP-024	Moderately Phytotoxic	0.57	MP-078	Moderately Phytotoxic	0.95
MP-033	Mildly Phytotoxic	0.12	MP-079	Highly Phytotoxic	1.26
MP-034	Mildly Phytotoxic	0.34	MP-100	Moderately Phytotoxic	0.51
MP-035	Severely Phytotoxic	2.18			

Soil CoC concentrations, with the exception of Cd, were generally greatly elevated compared to baseline levels reported by Moore and Woessner (2001). The concentrations of As, Cu, and Zn were also substantially greater than the upper ranges of phytotoxicity threshold values[10] (Figure 6). Concentrations of Pb were generally below the levels typically known to evoke phytotoxic responses. In that a given sample often contained elevated levels of more than one CoC, and phytotoxicity of these substances is known to be influenced by pH, our focus was on As, Cu, Zn, and pH.

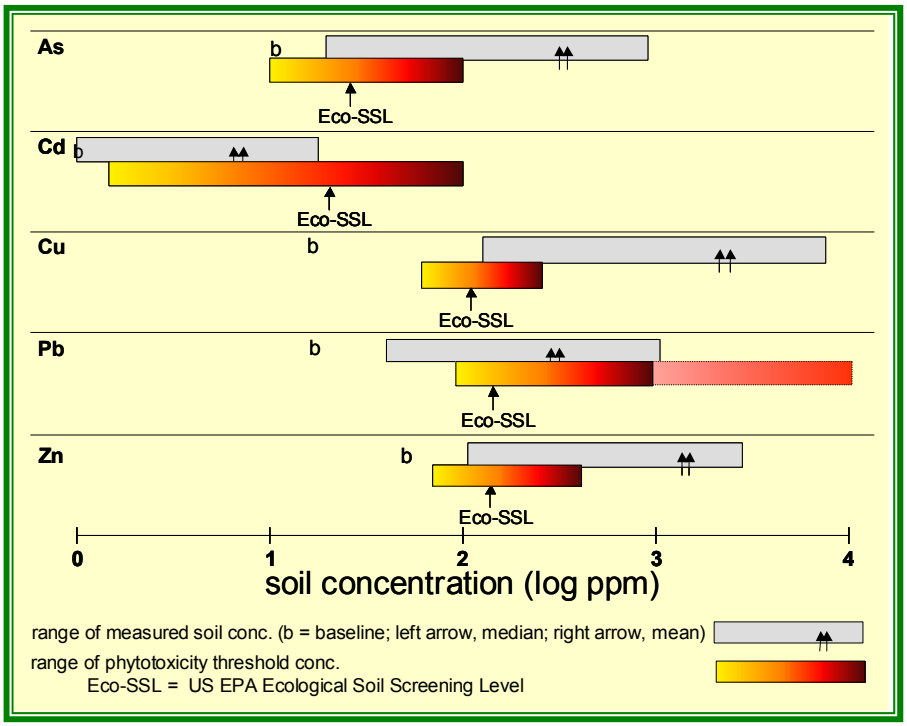


Figure 6. Comparison of measured soil CoC concentrations in GRKO samples used in phytotoxicity tests and the range of phytotoxic threshold concentrations.

Phytotoxicity endpoints were evaluated across the range of CoC concentrations. A weighting factor that adjusted concentrations of As, Cu, and Zn by pH was used (Kapustka *et al.*, 1995). Significant relationships were evident for growth and pH-adjusted metal concentrations. Total dry weight per plant regressed against the summed pH-adjusted metal concentrations indicated alfalfa was the most responsive species, followed by dogwood, then alder, and finally sedge (Figure 7, Figure 8, Figure 10). Because of the larger sample size, relationships demonstrated for alfalfa and alder are particularly strong.

[10] Phytotoxic threshold concentration ranges used in Figure 6 are derived from various publications including Lipton et al. (1993), Kabata-Pendias and Pendias, (1992). Eco-SSLs are soil concentrations developed by the US EPA for use in screening contaminated sites. The values are considered the point above which phytotoxicity may be a concern. The US EPA anticipates publishing the values sometime in 2002.

If data from the atypical soil samples in terms of organic matter (MP-018, MP-024, MP-056, MP-062, and MP-065) and pH (MP-079) are censored from the analyses, the correlation coefficient (R^2) for the alfalfa study rises from 0.650 (See alfalfa panel of Figure 8) to 0.756 (graph not shown).

Visual inspection of the scatterplots (for alfalfa and alder) revealed relatively large variance at the low range of pH-adjusted metal concentration and relatively lower variance as the pH-adjusted metal concentration increased. Also, the data suggested a trend of decreasing maximum plant growth as the pH-adjusted metal concentration rose. The basic concept embodied in the "Law of the Minimum" expressed by Liebig (1840) and refined by Blackman (1905) explains this common biological property. An environmental factor governs the maximum response attainable by an organism; at any interval along parameter gradient, other variables may curtail attainment of the potential. For example, at low concentrations of a toxicant, an organism may be deterred from attaining its growth potential by unfavorable temperature, moisture, nutrients, etc. The approach used to elucidate the limits on growth imposed by the CoC was to divide the range of pH-adjusted metal values into uniform intervals and to identify the maximum value of each interval. The nominal range of pH-adjusted metal concentration (0 to 15) was divided into equal intervals or bins of 1.5 units each. To eliminate bias that might occur in selecting bins, the start points were varied from –1.50 to +1.50 at 0.25 units; this resulted in 13 selections of interval bins. A polynomial (non-linear) regression was run using these maxima. The pH-adjusted metals concentration explained 85.5% of the observed variance in maximum plant growth (Figure 9).

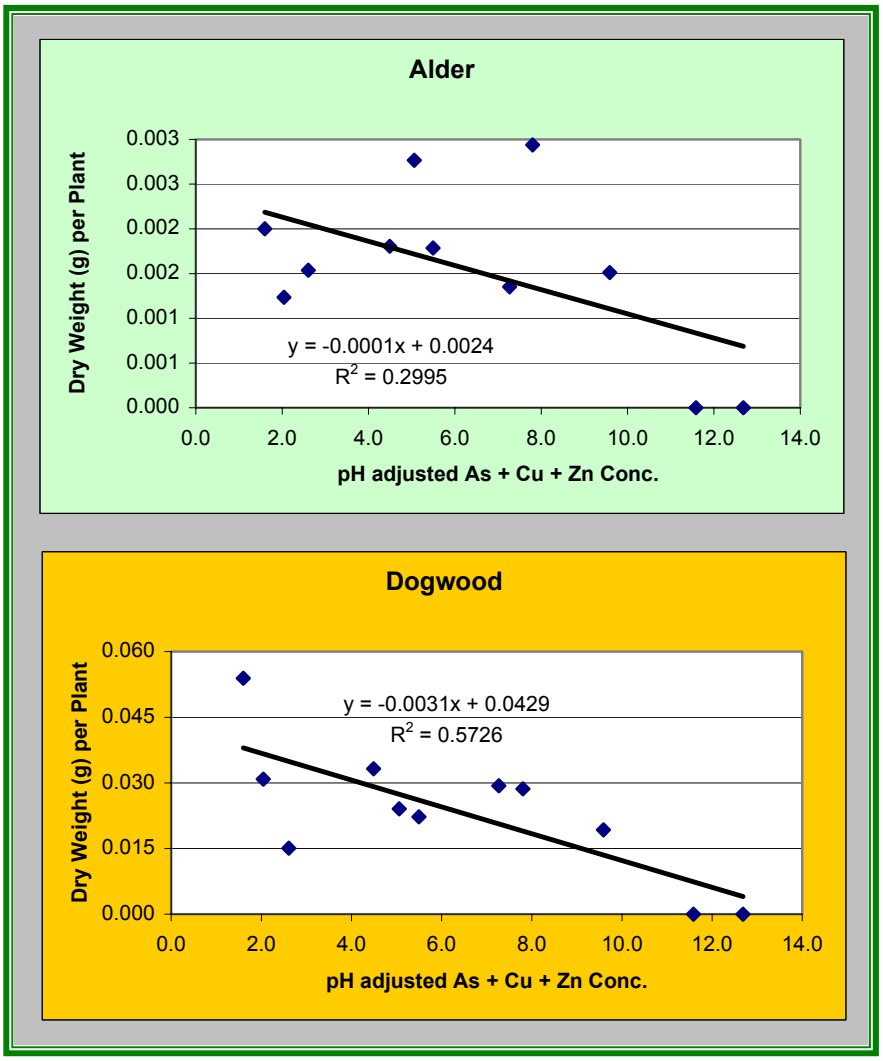


Figure 7. Linear regression of pH adjusted metal concentrations and dry weight per plant for alder and dogwood.

[n=11 for both alder and dogwood]

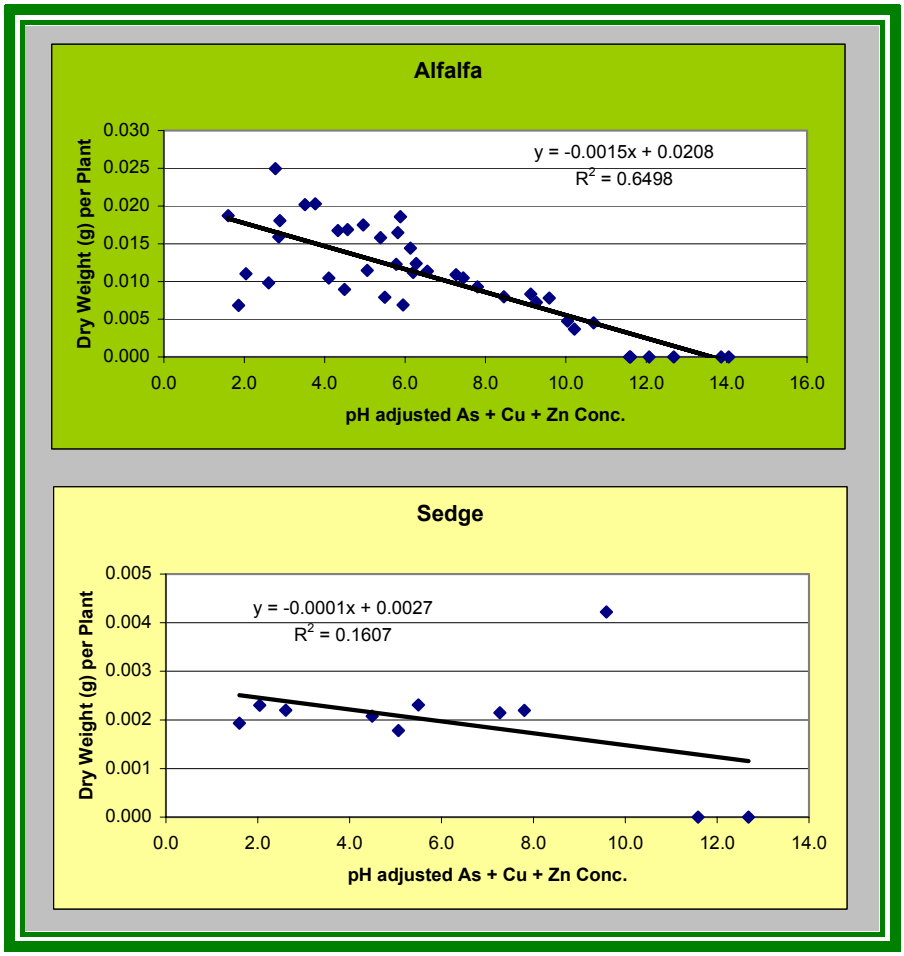


Figure 8. Linear regression of pH adjusted metal concentrations and dry weight per plant for alfalfa and sedge.

[n=41 for alfalfa; n=11 for sedge]

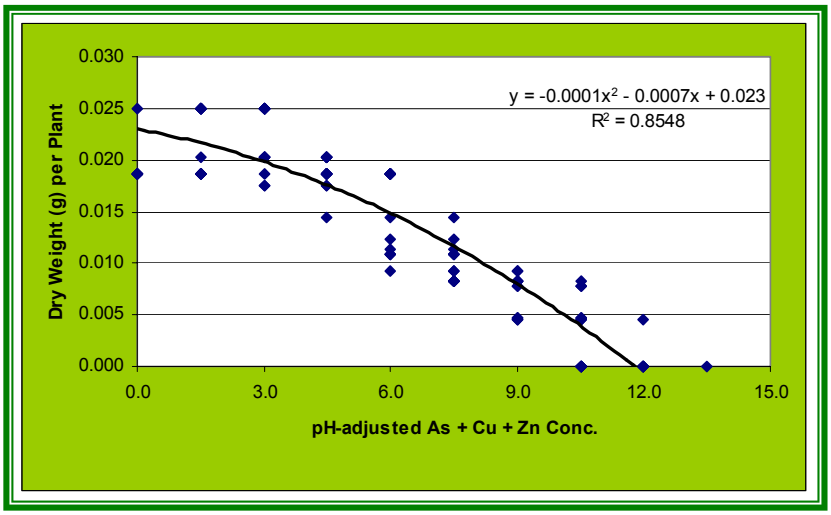


Figure 9. Polynomial regression of pH adjusted metal concentrations and maximum dry weight per plant for alfalfa.

The response of alder plants in the tests conducted in 2001 also demonstrated strong negative relationships to pH-adjusted metal concentrations. Survival, generally a poorly-responsive endpoint in short-term toxicity tests did show a sharp decline with pH-adjusted values above 12 (Figure 10). Very strong negative relationships occurred for the other quantitative endpoints including shoot height, net number of leaves, net number of branches, increase in root length, and total plant mass. As with alfalfa, scatterplots suggested a maximal value for many endpoints. Total plant dry weight regressed against pH-adjusted metals concentration showed a strong negative relationship for maximum growth, with 79.9% of the variance explained by the CoC (Figure 11).

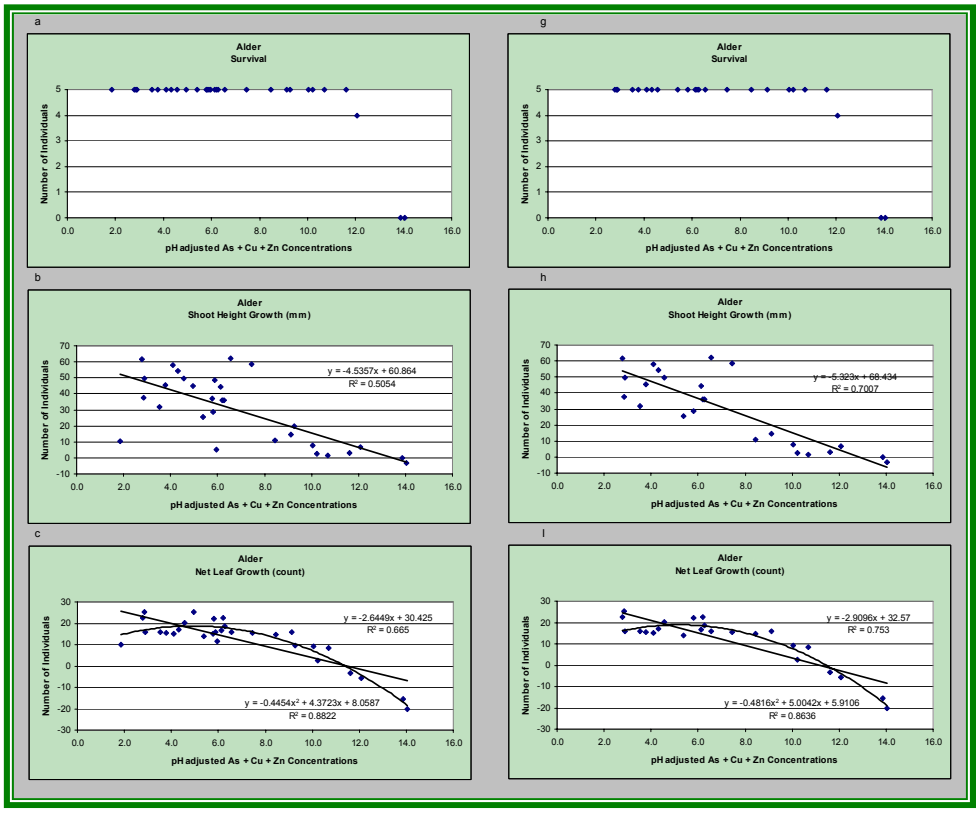


Figure 10. Linear and polynomial regression of pH adjusted metal concentrations for all data (n=45)and for censored data (n=39) respectively: for survival (a) and (g); shoot height (b) and (h); net leaf growth (c and i).

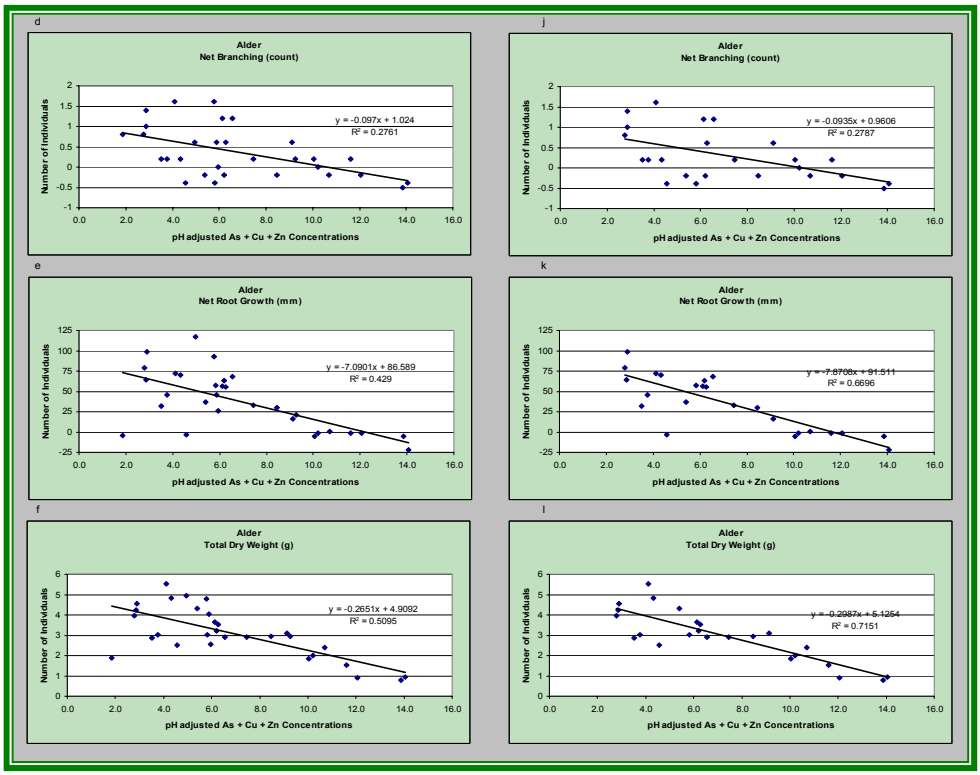


Figure 10. (cont). branching (d) and (j); root growth (e) and (k); and total dry weight (f) and (l).

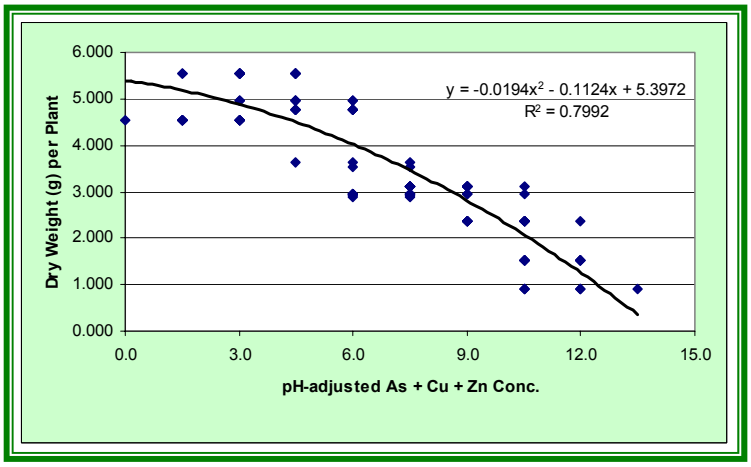


Figure 11. Polynomial regression of pH adjusted metal concentrations and maximum dry weight per plant for alder.

c) growth and re-growth of herbaceous vegetation in the field

Considerable variability in phytomass occurred among subplots, with a few high productivity plots skewing the mean higher than the median values (Table 8). The highest phytomass measured was from graminoids on plots with very high organic matter.

Table 8. Summary statistics for growth, regrowth, and productivity (phytomass g/0.25 m^2 clip-plot) from megaplots in 2001.

Life-form	Forb	Graminoid	Herbaceous
first harvest[1]			
Minimum	0.00	0.02	0.02
Maximum	10.96	64.36	64.38
Mean	1.92	13.88	15.80
Median	0.97	9.13	11.63
re-growth[2]			
Minimum	0.00	0.00	0.00
Maximum	30.87	165.60	165.60
Mean	5.56	19.43	24.99
Median	2.41	10.60	15.45
second harvest[3]			
Minimum	0.00	0.00	0.00
Maximum	50.75	215.74	215.74
Mean	9.25	34.41	43.66
Median	7.77	20.54	31.39
productivity[4]			
Minimum	0.00	0.00	0.00
Maximum	41.82	229.96	229.98
Mean	7.35	32.47	39.82
Median	3.86	20.11	28.83
standing crop[5]			
Minimum	0.00	0.00	0.00
Maximum	33.59	222.85	222.86
Mean	8.30	33.44	41.74
Median	7.21	17.97	30.14

[1] Harvest occurred from 29 May through 8 June 2001.

[2] Phytomass of sub-plots that grew between the first and second harvest.

[3] Harvest occurred from 25 July through 14 August 2001.

[4] The sum of phytomass from the first and second harvest.

[5] Standing crop is the mean of second harvest and productivity values.

The quantity of phytomass was significantly lowered by CoC. The pH-adjusted metal concentration was inversely related to phytomass (Table 9; Figure 12). In each group, the forbs were more responsive to pH-adjusted metal concentrations than were the graminoids. Consequently, the combined values (herbaceous phytomass) were often intermediary between forb and graminoid responses. However, for the second harvest and for the regrowth measurements, the combined herbaceous phytomass exhibited slightly stronger relationships to pH-adjusted metal concentrations. When soils with high organic matter and high pH were censored from the dataset, the strength of the relationship was increased considerably.

Table 9. Correlation coefficients (R^2) for phytomass measurements versus pH-adjusted metal concentrations.

Component	First Harvest	Second Harvest	Regrowth	Productivity	Standing Crop
All Data					
Forbs	0.2859	0.1560	0.2478	0.2851	0.2984
Graminoids	0.1444	0.1232	0.0572	0.0831	0.1048
Herbaceous	0.2232	0.2079	0.1295	0.1630	0.1916
Censored Data					
Forbs	0.4129	0.2222	0.2912	0.3534	0.3960
Graminoids	0.1871	0.1615	0.0781	0.1128	0.1435
Herbaceous	0.3351	0.3055	0.3121	0.3486	0.3807

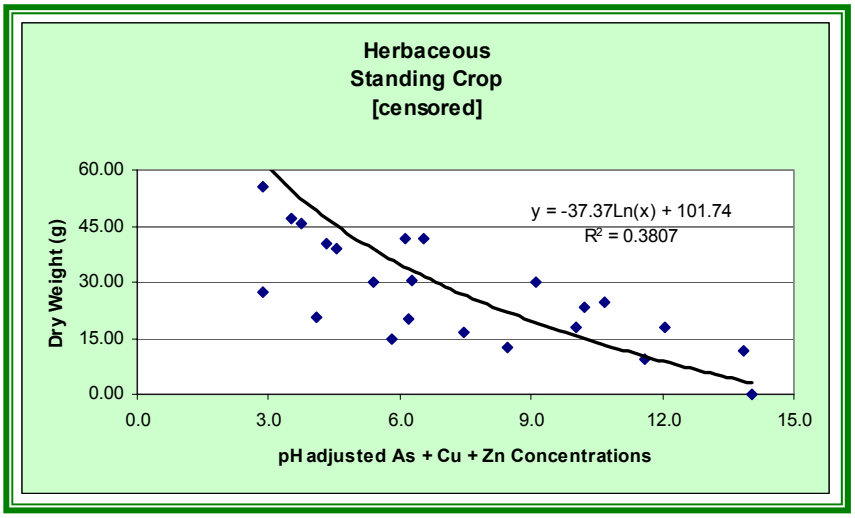


Figure 12. Relationship between herbaceous standing crop in the GRKO riparian area and pH-adjusted metal concentrations.

Many environmental factors affect the level of plant growth in the field. The concurrent influence of multiple factors contribute to the variability observed in the clip-plot data. When the maximum values across intervals are considered, the pH-adjusted metal concentrations explains 70% of the observed variability (Figure 13).

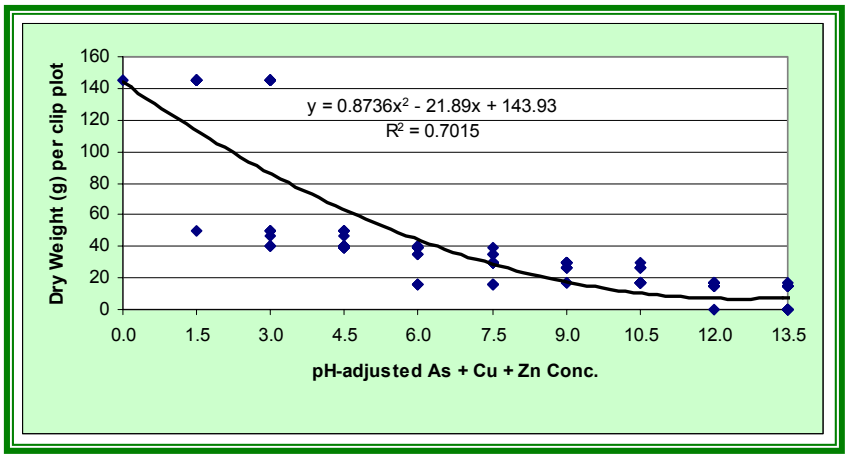


Figure 13. Maximum growth potential expressed in relation to pH-adjusted metals.

d) relationship between laboratory to field measures of plant growth

Data from the standardized phytotoxicity tests using alfalfa conducted in the laboratory and the measurements of herbaceous phytomass in clip-plots from the same megaplots were compared using linear regression (Figure 14). Outliers as discussed above (high organic matter and high pH) were removed from the data sets. One additional outlier, which had approximately 4-fold greater phytomass than the remaining data values, was also removed. This strong relationship validates the separate relationships described above between pH-adjusted metal concentrations and phytotoxicity and phytomass in the field.

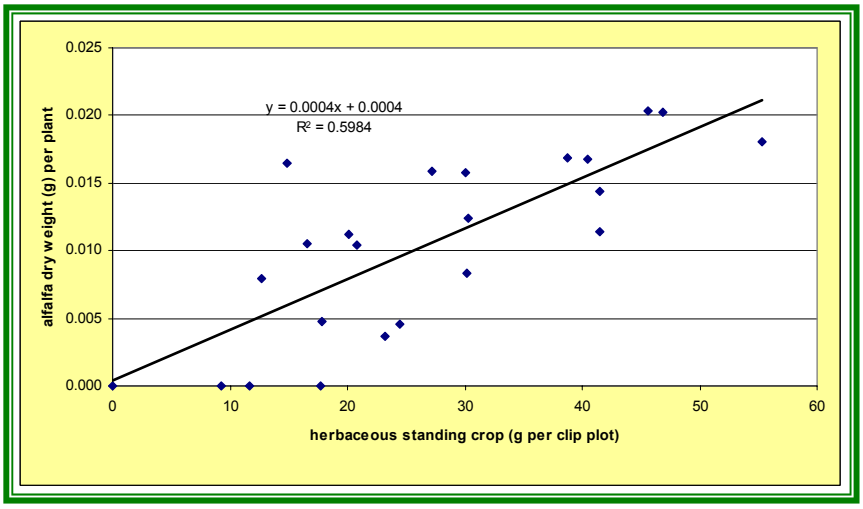


Figure 14. Linear regression of herbaceous standing crop from clip plots versus alfalfa phytomass per plant from laboratory toxicity tests from corresponding megaplot samples.

e) narrative descriptions from customized phytotoxicity tests

Alder plants in the shallow (5-cm) treatments rapidly showed adverse conditions as the leaves began to turn brown. The effect was most severe in the sub-irrigated treatments in which two of the three plants died and the third was essentially dead by harvest time. Similar response patterns were evident in alder for the other qualitative endpoints. For the other species, qualitative differences were less pronounced, though the pattern of diminished growth in the shallow treatments generally held. For several species-endpoints, plants qualitatively looked better in the sub-irrigated treatments than in the surface irrigated treatments. Such differences may reflect an initial stimulation of plant growth as CoC, especially Cu and Zn, were mobilized into the nutrient-limited Camas fill soil.

f) quantitative summaries from customized phytotoxicity tests

Mobility of CoC from tailings into uncontaminated fill soil was influenced by the type of watering (surface versus sub-irrigation). The pattern of movement was less pronounced for As than for Cu or Zn (Figure 15). In the sub-irrigated test units, copper movement into the uncontaminated surface layer elevated levels by 5- to 19-fold over starting concentrations; zinc was similarly elevated 2-7-fold. Surface irrigation resulted in increases in underlying uncontaminated soil of 13- to 15-fold for copper and 4- to 6-fold for zinc.

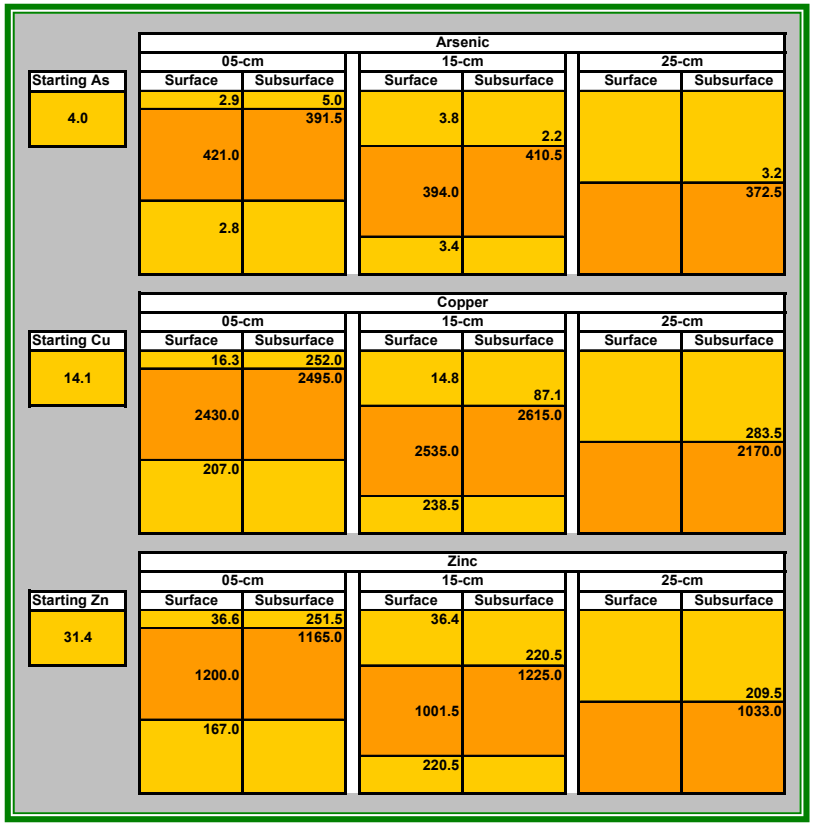


Figure 15. CoC concentrations at the start and end of customized phytotoxicity tests.

Plant growth was generally less in treatments receiving surface irrigation compared to sub-irrigated treatments. The riverine sand used as uncontaminated fill material is poor in nutrition and therefore not well suited for plant growth over extended periods as was the case in this study. Conversely, mobility of nutrients from tailings into the fill soil, including copper and zinc at low concentrations, may have stimulated growth of plants to some degree. However, comparisons within irrigation treatments reveal consistent patterns of suppressed growth with proximity to tailings. Generally, plants in the 5-cm treatments had markedly shorter shoots, shorter roots, and less phytomass than plants in the 15- and 25 cm depth treatments (Table 10). For surface irrigated treatments, this reflects the combination of root avoidance and suppression of root elongation exerted by CoC as the roots contacted the interface between tailings and fill. For sub-irrigated treatments, avoidance and suppression appears related to mobility of CoC, into the clean fill soil.

Table 10. Results of laboratory exposure to tailings buried at different depths and with alternative irrigation method.

Endpoint	surface			subsurface		
	5-cm	15-cm	25-cm	5-cm	15-cm	25-cm
alder						
shoot height (mm)	5.7	78.7	56.3	-1.3	64.7	117.7
root length (mm)	-24.3	29.7	113.0	-9.3	-0.3	76.7
dry weight (g) per plant	3.871	5.557	11.402	0.936	4.274	6.157
alfalfa						
shoot height (mm)	64.2	90.5	75.3	45.2	71.7	88.6
root length (mm)	82.8	152.0	198.0	75.7	174.3	229.4
dry weight (g) per plant	0.026	0.061	0.032	0.038	0.046	0.043
nodule number	1.3	2.4	1.5	0.1	0.2	0.5
sedge						
shoot height (mm)	31.3	14.3	28.0	51.7	250.3	278.0
root length (mm)	-36.3	28.7	145.7	-22.3	37.0	81.7
dry weight (g) per plant	1.003	2.269	1.677	0.814	2.042	2.721
wheat						
shoot height (mm)	331.1	317.3	306.4	236.1	415.5	449.6
root length (mm)	120.3	248.3	278.3	87.7	215.7	292.0
dry weight (g) per plant	0.120	0.145	0.147	0.145	0.449	0.706
willow						
shoot height (mm)	6.0	34.7	28.3	135.3	137.3	199.7
root length (mm)	-2.7	27.3	184.7	-8.7	53.3	104.0
dry weight (g) per plant	7.890	7.594	9.404	9.596	14.053	13.614

g) narrative descriptions from slant-box tests

Alfalfa and wheat plants reflected the low nutrient condition of the Camas soil used as clean fill material in the slant boxes. Plants were less sturdy than would be typical of plants grown in better soil. Nevertheless, a primary focus of the study, observation of root growth along the Plexiglas surface of the test units revealed information consistent with root avoidance of the tailings. For both alfalfa and wheat, the leading root tips grew downward until reaching the interface between Camas and the buried tailings. Once the roots reached the tailings, root growth was redirected laterally; roots

infrequently penetrated the tailings, and then for only a few millimeters. No consistent differences were noted in these general observations between the plants in sub-irrigated versus surface irrigated treatments. Over the course of the study, relatively little differences were apparent in the shoots of either alfalfa or wheat. Wheat plants flowered and set fruit near the end of the study.

h) narrative descriptions from field tests on the effects of buried tailings

Detailed observations on plant condition were recorded during the study period by Ms Jill Eckberg (appendix 5). Numerous photographs of the plots were taken as well. As noted by Ms Eckberg, the different species responded sporadically. The margins or tips of leaves of all three species were observed to brown and curl especially at the beginning and near the end of the study. At the beginning of the study, the observations likely reflect some degree of transplanting shock, especially in the high temperatures and drought conditions. Near the end of the study, the onset of seasonal senescence was manifest. Frost occurred within the final days of the study and contributed to the loss of leaves, especially for alder.

i) quantitative summaries from field tests on the effects of buried tailings

During the course of the 13-week field test, irrigation and evapotranspiration affected the distribution of CoC in the surficial fill material. Irrigation water, though carrying some CoC, would have leached readily soluble fractions of CoC from the surface soils. Rainfall occurred during mid-July at the time irrigation of the plots was ended. It is not known whether the rainfall had a detectable effect on concentrations of CoC in the fill material. Evapotranspiration would have drawn water and soluble CoC upward through the soil from buried tailings into the fill material. The net effect of these processes is seen in the level of increase of CoC in fill materials, especially at the shallower depths of 5-and 10-cm of fill (Figure 16). The soil sample was taken from approximately 0.5 to 1.5 cm from the tailings-fill interface. At the greater depths (i.e., 20- and 25-cm), there was less mobility of CoC.

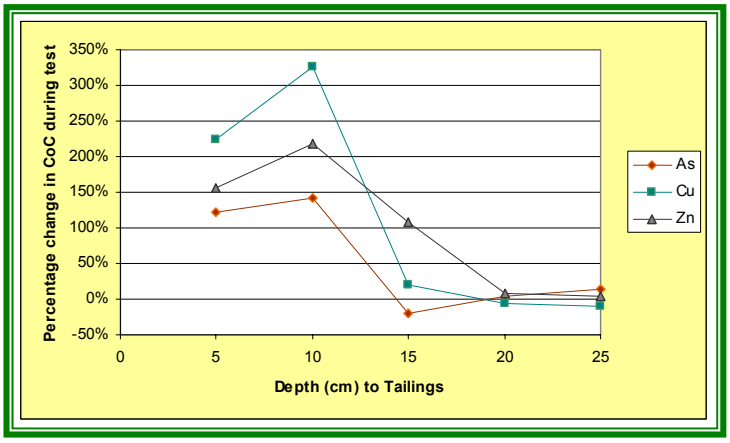


Figure 16. Percentage change of CoC in fill after the 13-week field study.

There were some differences in growth among the three sites, however, the differences were generally less than the differences among plots (depth to tailings). Alder plants experienced very limited growth across all plots and all treatments, though this may have been due in part to leaf fall just prior to harvesting the plants. Consequently, no apparent trends were evident for alder. For sedge and willow, there were general trends for increased growth (shoot height, rhizome number and length in sedge, and new root growth) as depth to tailings increased up to 20-cm depth (Figure 17).

Performance in the 25-cm depth plots was approximately equal to that in the 15-cm depth plots. Root mass (not shown here) had a similar though less pronounced pattern as root growth.[11]

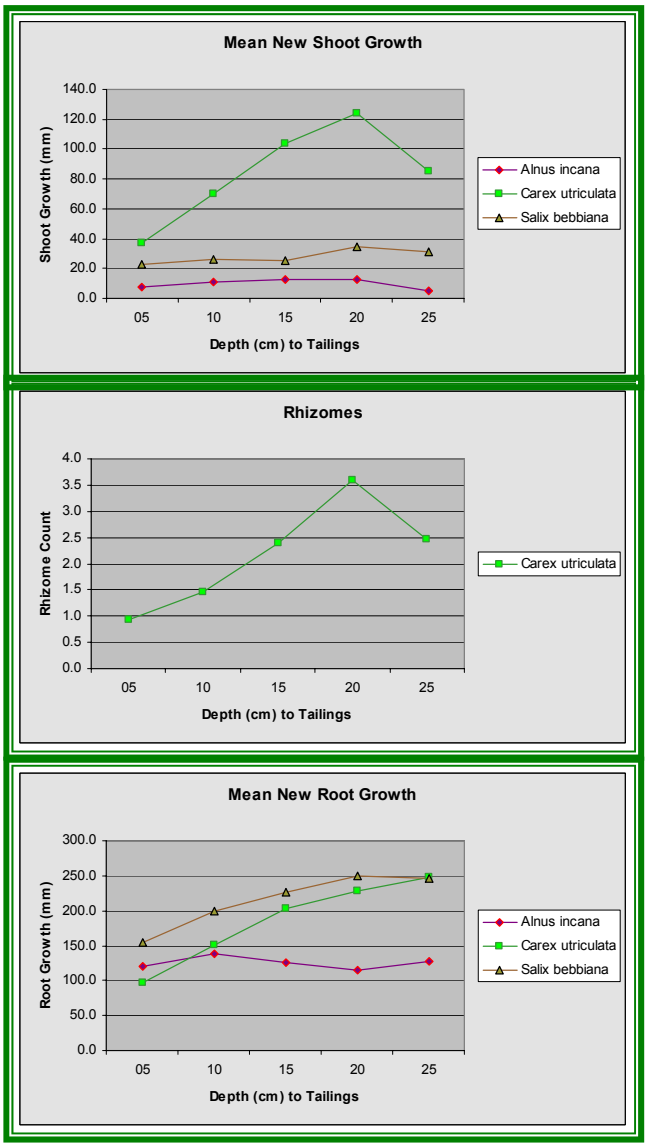


Figure 17. Plant growth after 13-weeks in plots with 5- to 25 cm depth to tailings.

[11] The measurement of mass for these plants was difficult to ascertain, as the starting mass of the plants was unknown. Guidelines do provide a means of estimating the mean starting mass by measuring sub-samples of the starting material. However, this would have required a large number of plants to be sacrificed at the start of the test and there were not sufficient numbers of plants available for purchase to accomplish this step.

4) conclusions

The phytotoxicity tests performed in the studies of riparian soils from the GRKO demonstrate statistically significant and ecologically meaningful adverse effects caused by the hazardous substances in the soils. The laboratory tests using standardized methods showed pronounced adverse effects in all species tested. The relationships were strongest for alfalfa and alder due to the larger number of samples tested using these species. As the phytotoxic effects are due to combinations of metals and pH, data were expressed as a pH-adjusted factor. Highly significant relationships between pH-adjusted metals and plant growth were evident. The magnitude of adverse effects was seen more clearly, when displayed as the maximum growth attainable across CoC concentration intervals. The magnitude of inhibition of growth is caused by CoC in the riparian soils. Approximately 85% of the reduction of maximum growth of alfalfa and 80% of the maximum growth of alder is explained by pH-adjusted metal concentrations of riparian soils from the GRKO.

Herbaceous growth in the riparian soils of the GRKO was impaired by CoC, with forbs being affected the most. Approximately 70% of the reduction of maximum herbaceous growth in the field is explained by pH-adjusted metal concentrations of riparian soils from the GRKO. Megaplot phytomass growth and growth in laboratory phytotoxicity tests were highly similar, with 60% of the variability accounted for. Together these establish a strong connection between the laboratory results and field observations linking impairment to levels of CoC.

Mobility of CoC from buried tailings pose a substantial risk to plants growing in the riparian zone. Customized tests in the field and the laboratory demonstrate that CoC do mobilize as water-soluble fractions into uncontaminated soils both above and below[12] the buried tailings. Plant response to the CoC shows some indications of stimulation as would be expected at low, initial concentrations. Phytotoxic responses occurred at shallow depths, as roots contacted higher concentrations of CoC. Even in those treatments where phytotoxicity was not pronounced, root avoidance was apparent. The ecological consequence of such root avoidance would be manifest in the field under several conditions. Generally, plants with shallow root systems would be more susceptible to drought stress, high and low temperature stress, and to grazing impacts. The shallower root systems also would provide less soil holding capacity against erosive forces.

5) references cited

ASTM. 2000. Standard Guide for Conducting Terrestrial Plant Toxicity Tests. Designation: E 1963-98 *Annual Book of Standards*. American Society for Testing and Materials. West Conshohocken, PA.

Blackman, F. F. 1905. Optima and lighting factors. *Annals of Botany* 14: 281-295.

Gannon, J. E. 2001. *Relationship of Heavy Metals to Soil Respiration, Grant-Kohrs Ranch, Montana*. Technical Data Report submitted to the U.S. Department of Interior.

Lipton, J., H. Galbraith, K. LeJeune, H. Bergman, L. Kapustka, and L. McDonald. 1993. *Terrestrial Resources Injury Assessment Report, Upper Clark Fork River Basin.* Prepared for State of Montana Natural Resource Damage Litigation Program, Helena, MT.

Kabata-Pendias, A. and H. Pendias. 1992. *Trace elements in soil and plants. 2nd Ed.* CRC Press, Inc. Boca Raton, FL.

Kapustka, L. A. 1997. Selection of phytotoxicity tests for use in ecological risk assessments. Chapter 17, pages 515-548 in Wang, W., J. Gorsuch, and J. S. Hughes, eds. *Plants for environmental studies.* Lewis Press, Boca Raton, FL.

Kapustka, L. A., J. Lipton, H. Galbraith, D. Cacela, and K. LeJeune. 1995. Laboratory phytotoxicity studies: Metal and arsenic impacts to soils, vegetation communities, and wildlife habitat in southwest Montana uplands contaminated by smelter emission. *Environ. Toxicol. and Chem.* 14:1905-1912.

[12] Our data for mobilization to uncontaminated soil is only from laboratory tests; field studies were not designed to document downward movement of CoC from tailings.

Liebig, J. 1840. *Chemistry and its application in agriculture and physiology.* Taylor and Walton, London.

Moore, J. N. and W. Woessner. 2001. *Geologic, Soil Water and Groundwater Resources Injury Assessment Report, Grant-Kohrs Ranch National Historic Site*. Technical Data Report submitted to the U.S. Department of Interior. StatSoft, Inc. 1997. *STATISTICA for Windows, Release 5.1, '97 Edition*. StatSoft, Inc. 2325 East 13th Street, Tulsa, OK 74104.

6) list of appendices

Appendix 1
Chemistry 2000 and 2001

Soil Sample Name	Soil pH	% Organic Carbon	Arsenic (ppm)	Cadmium (ppm)	Copper (ppm)	Lead (ppm)	Zinc (ppm)
MT-01	7.60	n.d.	39	7.1	1300	153	1867
MT-02	7.30	n.d.	447	3.8	1700	400	1200
MT-03	7.60	n.d.	51	1.3	120	52	127
MT-04	6.60	n.d.	179	4.1	1040	202	1064
MT-05	8.10	n.d.	290	6.6	2033	267	1367
MT-06	4.90	n.d.	343	5.6	4600	293	1533
MT-07	8.20	n.d.	220	5.5	1867	247	1067
MT-08	7.10	n.d.	213	8.1	1567	217	1867
MT-09	8.50	n.d.	57	1.6	157	41	109
MT-10	5.30	n.d.	287	5.8	4633	243	2300
MT-11	6.50	n.d.	420	6.6	2867	350	1667
MT-12	7.20	n.d.	117	7.3	857	137	1233
MT-13	6.60	n.d.	357	4.9	2400	313	1367
MT-14	7.90	n.d.	26	3.4	803	123	967
MT-15	5.80	n.d.	323	5.5	2100	287	1433
MP-018	7.28	10.9	620	12	3,800	430	2,200
MP-019	7.53	3.2	220	16	1,600	230	2,300
MP-021	7.24	0.9	96	7.2	710	520	1,000
MP-022	7.77	2.5	140	8.0	880	160	1,300
MP-024	7.27	14.6	410	11	4,400	570	2,200
MP-033	7.56	4.6	32	4.3	980	140	910
MP-034	7.59	1.0	80	3.2	600	110	900
MP-035	5.09	2.9	520	4.5	2,800	390	1,500
MP-036	6.95	4.9	250	6.2	2,500	290	1,500
MP-042	6.62	6.2	160	4.9	1,500	320	1,100
MP-051	5.85	2.8	560	8.2	4,600	530	2,200
MP-053	5.20	2.7	460	4.7	2,700	370	1,300
MP-056	6.25	8.8	880	8.5	7,100	1,100	1,700
MP-057	7.32	4.5	790	11	6,300	820	2,900
MP-058	6.35	4.4	500	10	3,300	440	2,000
MP-059	6.11	5.0	480	8.5	2,900	400	2,100
MP-060	5.30	2.2	340	3.8	1,200	320	940
MP-062	7.04	7.6	310	6.1	2,700	320	1,400
MP-065	6.98	8.1	55	6.9	1,200	260	1,200
MP-066	4.50	1.7	410	6.0	3,300	360	1,700
MP-067	7.29	4.3	640	7.9	4,100	640	1,900
MP-068	7.32	5.9	500	6.3	2,900	420	1,500
MP-069	7.05	4.6	350	8.5	4,100	400	1,900
MP-070	5.76	4.0	690	4.9	2,300	560	1,300
MP-071	4.23	1.3	320	3.9	1,400	310	1,200
MP-072	7.43	1.5	110	3.5	780	140	720
MP-077	7.50	2.6	250	5.4	2,600	230	1,800
MP-078	6.54	3.0	260	13	1,600	250	2,800
MP-079	8.25	2.1	230	5.0	1,600	210	1,100
MP-100	7.49	3.1	160	7.5	920	190	1,200

Appendix 1
Slickens Field Chemistry

Soil Sample Name	ep and t Sample Number	Lab Sample Number	As (ppm)	Cu (ppm)	Zn (ppm)
5 cm Slickens	01	8212501	587.0	2300.0	1440.0
10 cm Slickens	02	8212502	670.0	1640.0	1370.0
15 cm Slickens	03	8212503	544.0	689.0	1110.0
20 cm Slickens	04	8212504	764.0	1800.0	1180.0
25 cm Slickens	05	8212505	566.0	684.0	804.0
5 cm Fill	06	8212506	11.8	79.9	77.1
10 cm Fill	07	8212507	12.8	105.0	95.8
15 cm Fill	08	8212508	4.2	29.6	62.9
20 cm Fill	09	8212509	5.5	23.2	32.8
25 cm Fill	10	8212510	6.0	22.3	31.1
Fill	Fill A	81941025	4.7	28.9	24.4
Fill	Fill B	81941026	5.8	21.7	33.2
Fill	Fill C	81941027	5.5	23.4	32.7

Larry Kapustka:
Slickens and Fill samples by depth are from the post-test harvest of field plots from the Slickens Dynamics study.

Larry Kapustka:
Fill A, B, and C are aliquots of CFR fill sand used in field plots of the Slickens Dynamics study for Sites 1, 2, and 3 respectively.

Appendix 1
Slickens Lab Chemistry

Description	Treatment	Watering	Soil Type	Position	Species	Lab Sample	As	Cu	Zn
SI-5-cm Camas-U, Sedge	05-cm	Surface	Camas	Upper	Sedge	81941001	2.8	13.7	33.1
SI-5-cm Camas-U, Willow	05-cm	Surface	Camas	Upper	Willow	81941002	3.0	18.8	40.1
SI-5-cm Slickens, Sedge	05-cm	Surface	Slickens	Middle	Sedge	81941003	405.0	2290.0	1120.0
SI-5-cm Slickens, Willow	05-cm	Surface	Slickens	Middle	Willow	81941004	437.0	2570.0	1280.0
SI-5-cm Camas-L, Sedge	05-cm	Surface	Camas	Lower	Sedge	81941005	2.1	272.0	205.0
SI-5-cm Camas-L, Willow	05-cm	Surface	Camas	Lower	Willow	81941006	3.5	142.0	129.0
SI-15-cm Camas-U, Sedge	15-cm	Surface	Camas	Upper	Sedge	81941007	3.4	14.8	32.0
SI-15-cm Camas-U, Willow	15-cm	Surface	Camas	Upper	Willow	81941008	4.1	14.7	40.8
SI-15-cm Slickens, Sedge	15-cm	Surface	Slickens	Middle	Sedge	81941009	391.0	2260.0	913.0
SI-15-cm Slickens, Willow	15-cm	Surface	Slickens	Middle	Willow	81941010	397.0	2810.0	1090.0
SI-15-cm Camas-L, Sedge	15-cm	Surface	Camas	Lower	Sedge	81941011	2.9	225.0	213.0
SI-15-cm Camas-L, Willow	15-cm	Surface	Camas	Lower	Willow	81941012	3.9	252.0	227.0
SSI-5-cm Camas, Sedge	05-cm	Sub-Surface	Camas	Upper	Sedge	81941013	5.6	222.0	232.0
SSI-5-cm Camas, Willow	05-cm	Sub-Surface	Camas	Upper	Willow	81941014	4.4	282.0	271.0
SSI-5-cm Slickens, Sedge	05-cm	Sub-Surface	Slickens	Middle	Sedge	81941015	385.0	2590.0	1160.0
SSI-5-cm Slickens, Willow	05-cm	Sub-Surface	Slickens	Middle	Willow	81941016	398.0	2400.0	1170.0
SSI-15-cm Camas, Sedge	15-cm	Sub-Surface	Camas	Upper	Sedge	81941017	2.0	66.1	188.0
SSI-15-cm Camas, Willow	15-cm	Sub-Surface	Camas	Upper	Willow	81941018	2.3	108.0	253.0
SSI-15-cm Slickens, Sedge	15-cm	Sub-Surface	Slickens	Middle	Sedge	81941019	422.0	2640.0	1260.0
SSI-15-cm Slickens, Willow	15-cm	Sub-Surface	Slickens	Middle	Willow	81941020	399.0	2590.0	1190.0
SSI-25-cm Camas, Sedge	25-cm	Sub-Surface	Camas	Upper	Sedge	81941021	2.9	170.0	139.0
SSI-25-cm Camas, Willow	25-cm	Sub-Surface	Camas	Upper	Willow	81941022	3.4	397.0	280.0
SSI-25-cm Slickens, Sedge	25-cm	Sub-Surface	Slickens	Middle	Sedge	81941023	394.0	2330.0	1130.0
SSI-25-cm Slickens, Willow	25-cm	Sub-Surface	Slickens	Middle	Willow	81941024	351.0	2010.0	936.0
		pre-test concentrations		Camas #1		8212513	3.6	13.1	30.1
		pre-test concentrations		Camas #2		8212514	4.3	15.1	32.6

Larry Kapustka:
These data (rows 2 through 25) are of post- harvest soil samples fo the laboratgory portion of the Slickens Dynamics study (PT-3).

Larry Kapustka:
Camas #1 and #2 were aliquots of batch Camas soil used for the customized laboratory tests (PT-3) Slickens Dynamics.

Appendix 2 a -- Compiled Phytotoxicity Data PT1 (2000)
Endpoint (Means)

Species	Sample	Emergence Count	PE 7 Count	PE 7 Height	PE 7 Shoot Color	PE 7 Shoot Appearance	PE 14 Count	PE 14 Height	PE 14 Shoot Color	PE 14 Shoot Appearance	PE 21 Count
Alder	**MT-00**		6.8	0.0	0.0	0.0	7.0	0.0	0.0	0.0	
	MT-01		7.6	0.0	0.0	0.0	7.4	-0.4	0.0	0.0	
	MT-02		6.0	0.0	0.0	0.0	5.8	-0.2	0.0	0.0	
	MT-03		4.8	0.0	0.0	0.0	4.6	-1.0	0.0	-0.6	
	MT-04		5.2	0.0	0.0	0.0	6.6	0.0	0.0	0.0	
	MT-05		5.4	-0.2	-0.2	0.0	4.2	-0.4	0.0	-0.4	
	MT-06		0.6	-2.0	-0.7	0.0	0.0				
	MT-07		6.0	0.0	0.0	0.0	5.6	-0.4	-0.4	-0.4	
	MT-08		8.6	0.0	0.0	0.0	8.4	-0.8	0.0	-0.4	
	MT-09		5.8	-0.4	0.0	-0.2	5.2	-0.6	0.0	-1.0	
	MT-10		2.4	-2.0	-0.8	-0.5	0.0				
	MT-11		8.6	-0.2	0.0	-0.2	7.0	-1.2	-0.8	-1.0	
	MT-12		6.4	0.0	0.0	0.0	7.8	-0.2	0.0	-0.2	
	MT-13		6.0	0.0	0.0	0.0	5.8	-1.5	0.0	-1.5	
	MT-14		8.4	0.0	0.0	0.0	8.0	0.0	0.0	0.0	
	MT-15		7.4	-0.4	0.0	0.0	7.2	-0.6	0.0	-0.2	
Alfalfa	**MT-00**	13.8	13.8	0.0	0.0	0.0					
	MT-01	12.4	12.4	0.0	0.0	0.0					
	MT-02	10.8	10.2	-1.4	-1.4	0.0					
	MT-03	13.6	13.8	-1.6	-0.2	0.0					
	MT-04	13.0	13.2	-0.6	-0.2	0.0					
	MT-05	13.2	12.8	-2.2	-1.6	0.0					
	MT-06	0.0	0.0								
	MT-07	14.4	14.4	-1.6	-1.0	0.0					
	MT-08	14.0	13.8	-2.0	-1.4	0.0					
	MT-09	13.3	13.0	-1.0	-1.5	0.0					
	MT-10	0.0	0.0								
	MT-11	12.2	11.6	-2.6	-1.4	-0.3					
	MT-12	9.4	9.8	-1.8	-1.4	-0.2					
	MT-13	13.4	13.8	-1.8	-1.6	0.0					
	MT-14	13.6	13.6	-1.2	0.0	0.0					
	MT-15	13.6	12.4	-2.8	-1.0	-0.2					

Appendix 2 a -- Compiled Phytotoxicity Data PT1 (2000)
Endpoint (Means)

Species	Sample	PE 21 Height	PE 21 Shoot Color	PE 21 Shoot Appearance	Count	Shoot Color	Shoot Appearance	Mean Shoot Height (mm)	Root Color	Root Appearance	Mean Root Length (mm)	Mean Nodule Number
Alder	**MT-00**				7.2	0.0	0.0	11.1	0.0	0.0	17.8	
	MT-01				7.2	-1.8	0.0	9.8	-0.2	-1.8	27.5	
	MT-02				5.8	-1.8	-0.8	11.1	-0.8	-1.8	16.8	
	MT-03				4.6	-0.6	-0.4	11.4	-1.6	-1.6	33.0	
	MT-04				5.8	-0.2	-0.4	18.1	-0.6	-1.4	23.9	
	MT-05				4.0	-1.4	-1.6	11.6	-2.3	-3.5	10.8	
	MT-06				0.0						0.0	
	MT-07				5.0	-1.2	-1.6	10.6	-0.8	-2.8	23.4	
	MT-08				7.4	-1.6	-2.4	8.7	-0.4	-3.0	17.2	
	MT-09				4.0	-1.6	-1.8	9.5	-0.8	-3.2	24.0	
	MT-10				0.0						0.0	
	MT-11				5.6	-2.5	-2.5	9.8	-1.0	-3.5	10.0	
	MT-12				7.4	-0.6	-0.6	11.3	-0.4	-1.0	27.6	
	MT-13				4.6	-2.5	-2.3	7.5	-2.8	-3.0	11.5	
	MT-14				7.8	-1.8	-2.0	10.4	-0.8	-1.8	25.8	
	MT-15				7.0	-1.8	-2.4	9.2	-1.4	-3.2	11.3	
Alfalfa	**MT-00**				13.8	0.0	0.0	54.0	0.0	0.0	83.1	2.5
	MT-01				12.2	0.0	0.0	81.6	0.0	0.0	99.6	2.5
	MT-02				10.8	-1.0	-0.2	43.8	-1.0	-1.0	43.6	0.0
	MT-03				13.8	0.0	0.0	55.8	0.0	0.0	111.5	1.7
	MT-04				13.0	0.0	0.0	88.1	0.0	0.0	116.1	2.0
	MT-05				12.4	-1.6	-0.6	33.2	-1.4	-1.4	59.1	0.3
	MT-06				0.0						0.0	0.0
	MT-07				14.6	-1.0	0.0	49.6	-0.6	-0.4	87.7	0.8
	MT-08				14.0	-1.4	-0.4	36.9	-1.8	-2.0	52.3	0.0
	MT-09				13.5	-1.5	-0.3	47.5	-0.5	-0.5	72.0	1.0
	MT-10				0.0						0.0	0.0
	MT-11				12.0	-1.2	-1.4	34.9	-1.0	-2.0	50.0	0.0
	MT-12				9.6	-2.6	-0.6	39.2	-1.0	-2.6	51.2	0.9
	MT-13				14.0	-2.4	-1.0	46.3	-1.0	-2.4	47.0	0.0
	MT-14				13.6	0.0	0.0	77.6	0.0	0.0	106.9	2.0
	MT-15				13.2	-1.8	-1.0	30.5	-1.2	-2.2	43.2	0.0

Appendix 2 a -- Compiled Phytotoxicity Data PT1 (2000)
Endpoint (Means)

Species	Sample	Shoot Dry Weight (g)	Root Dry Weight (g)	Total Dry Weight (g)	Total Dry Weight per Plant (g)
Alder	**MT-00**	0.014	0.009	0.023	0.003
	MT-01	0.012	0.007	0.019	0.003
	MT-02	0.010	0.005	0.016	0.003
	MT-03	0.006	0.005	0.011	0.002
	MT-04	0.016	0.006	0.022	0.004
	MT-05	0.004	0.002	0.007	0.002
	MT-06	0.000	0.000	0.000	0.000
	MT-07	0.004	0.002	0.006	0.001
	MT-08	0.009	0.004	0.013	0.002
	MT-09	0.005	0.003	0.008	0.002
	MT-10	0.000	0.000	0.000	0.000
	MT-11	0.012	0.008	0.021	0.003
	MT-12	0.010	0.004	0.013	0.002
	MT-13	0.006	0.002	0.008	0.001
	MT-14	0.010	0.006	0.016	0.002
	MT-15	0.009	0.002	0.011	0.002
Alfalfa	**MT-00**	0.184	0.116	0.299	0.022
	MT-01	0.234	0.053	0.286	0.024
	MT-02	0.105	0.020	0.125	0.011
	MT-03	0.105	0.057	0.162	0.012
	MT-04	0.310	0.085	0.395	0.031
	MT-05	0.097	0.024	0.121	0.010
	MT-06	0.000	0.000	0.000	0.000
	MT-07	0.120	0.041	0.161	0.011
	MT-08	0.087	0.024	0.111	0.008
	MT-09	0.132	0.035	0.167	0.012
	MT-10	0.000	0.000	0.000	0.000
	MT-11	0.088	0.024	0.113	0.009
	MT-12	0.071	0.015	0.087	0.009
	MT-13	0.134	0.019	0.153	0.011
	MT-14	0.198	0.057	0.255	0.019
	MT-15	0.079	0.024	0.103	0.008

Appendix 2 a -- Compiled Phytotoxicity Data PT1 (2000)
Endpoint (Means)

Species	Sample	Emergence Count	PE 7 Count	PE 7 Height	PE 7 Shoot Color	PE 7 Shoot Appearance	PE 14 Count	PE 14 Height	PE 14 Shoot Color	PE 14 Shoot Appearance	PE 21 Count
Dogwood	**MT-00**		7.6	0.0	0.0	0.0	8.2	0.0	0.0	0.0	8.0
	MT-01		7.2	-0.2	-0.2	-0.2	8.2	-0.8	-0.2	0.0	8.2
	MT-02		7.8	-0.2	0.0	-0.2	7.6	-0.6	-0.6	-0.4	8.0
	MT-03		7.8	-1.0	0.0	-0.4	7.8	-2.2	-0.2	-0.2	7.8
	MT-04		6.6	-0.8	0.0	-0.4	7.4	-1.0	0.0	-0.4	7.2
	MT-05		5.0	-1.6	-0.2	-1.0	6.8	-2.0	-1.0	-1.8	6.2
	MT-06		0.0				0.0				0.0
	MT-07		7.8	-0.6	0.0	-0.4	8.4	-1.2	-0.2	-0.4	7.8
	MT-08		7.4	-0.4	-0.4	-0.4	7.8	-1.0	-0.6	-0.8	7.2
	MT-09		6.2	-1.8	-0.5	-1.0	5.8	-2.0	-1.5	-0.8	5.4
	MT-10		0.0				1.2	-2.0	-3.0	0.0	0.0
	MT-11		9.0	-0.8	-0.2	-0.4	9.0	-1.6	-1.4	0.0	9.0
	MT-12		9.0	-0.4	-0.2	-0.2	9.0	-0.8	-0.6	0.0	8.8
	MT-13		8.3	-1.0	-0.2	-0.6	8.8	-2.0	-1.4	-0.6	9.0
	MT-14		8.8	-1.2	-0.2	-0.6	8.8	-1.8	0.0	-0.6	8.6
	MT-15		8.6	-2.0	-0.2	-0.8	8.2	-2.6	-1.2	-0.8	8.4
Sedge	**MT-00**		9.0	0.0	0.0	0.0	8.0	0.0	0.0	0.0	
	MT-01		9.0	-0.2	-0.6	0.0	8.6	-2.0	-1.0	0.0	
	MT-02		9.4	-0.2	-0.4	0.0	9.0	-2.4	-1.2	-0.4	
	MT-03		9.0	-0.2	-0.2	0.0	8.4	-1.2	-0.2	0.0	
	MT-04		9.0	0.0	-0.2	0.0	7.8	-0.6	0.0	0.0	
	MT-05		9.0	-0.2	-0.4	0.0	8.2	-2.2	-1.2	-0.4	
	MT-06		0.0				0.0				
	MT-07		9.0	0.0	0.0	0.0	9.0	-2.0	-0.8	0.0	
	MT-08		9.0	0.0	0.0	0.0	8.8	-1.2	-1.2	0.0	
	MT-09		9.0	0.0	-1.0	0.0	8.5	-1.8	-1.3	0.0	
	MT-10		3.6	-3.2	-3.0	0.0	0.0				
	MT-11		9.0	-0.2	-0.4	0.0	9.0	-3.0	-1.8	-0.2	
	MT-12		9.0	-0.8	-0.2	0.0	8.8	-2.8	-0.8	0.0	
	MT-13		9.0	-0.8	-0.2	0.0	8.8	-2.4	-1.4	-0.2	
	MT-14		9.0	-0.4	-0.2	0.0	9.0	-1.8	-0.8	0.0	
	MT-15		9.0	-0.2	-0.2	0.0	9.0	-1.8	-1.4	0.0	

Appendix 2 a -- Compiled Phytotoxicity Data PT1 (2000)
Endpoint (Means)

Species	Sample	PE 21 Height	PE 21 Shoot Color	PE 21 Shoot Appearance	Count	Shoot Color	Shoot Appearance	Mean Shoot Height (mm)	Root Color	Root Appearance	Mean Root Length (mm)	Mean Nodule Number
Dogwood	**MT-00**	0.0	0.0	0.0	8.0	0.0	0.0	48.8	0.0	0.0	68.1	
	MT-01	-1.2	-0.4	-0.2	8.2	0.0	0.0	58.6	-0.4	0.0	73.8	
	MT-02	-1.8	-2.2	-0.6	8.2	-1.6	-0.4	40.3	-0.4	-2.2	32.6	
	MT-03	-2.4	-0.4	0.0	7.6	-0.6	0.0	51.3	-0.6	0.0	78.8	
	MT-04	-0.4	0.0	-0.4	6.8	0.0	0.0	78.7	-0.6	0.0	90.5	
	MT-05	-3.0	-1.8	-1.4	5.6	-2.0	-2.2	32.4	-0.8	-3.0	30.3	
	MT-06				0.0							
	MT-07	-2.2	-0.8	-0.2	7.8	-1.0	-1.2	46.6	-1.0	-0.6	63.6	
	MT-08	-2.0	-2.8	-0.4	7.6	-2.2	-2.6	38.7	-2.2	-2.8	40.9	
	MT-09	-2.0	-2.3	-1.0	5.4	-1.8	-0.8	47.6	-1.8	-1.0	58.2	
	MT-10				0.0							
	MT-11	-1.8	-2.8	-0.2	9.0	-1.0	-1.0	45.0	-2.0	-1.6	41.8	
	MT-12	-1.4	-2.2	0.0	8.8	-1.4	-0.6	49.6	-0.6	-0.6	61.7	
	MT-13	-1.6	-2.2	-0.8	9.0	-1.8	-0.6	51.0	-1.4	-0.4	55.4	
	MT-14	-0.4	0.0	-0.2	8.6	0.0	0.0	61.1	0.0	0.0	91.9	
	MT-15	-3.2	-2.8	-1.8	8.2	-3.0	-2.6	32.4	-2.6	-3.0	38.8	
Sedge	**MT-00**				7.0	0.0	0.0	64.7	0.0	0.0	75.9	
	MT-01				8.2	-2.0	-0.8	35.3	0.0	-1.2	31.5	
	MT-02				7.8	-1.8	-1.8	33.7	0.0	-2.2	15.3	
	MT-03				7.0	0.0	0.0	57.6	0.0	0.0	84.5	
	MT-04				7.6	0.0	0.0	53.6	0.0	-1.2	42.1	
	MT-05				6.4	-2.0	-1.0	32.2	-0.2	-2.6	21.0	
	MT-06				0.0						0.0	
	MT-07				8.6	-1.8	-0.4	46.2	0.0	-1.4	41.5	
	MT-08				8.4	-2.0	-1.0	40.0	0.0	-2.0	19.9	
	MT-09				5.4	-1.8	0.0	37.9	0.0	-2.3	34.6	
	MT-10				0.0						0.0	
	MT-11				8.2	-2.4	-0.4	35.7	-0.4	-3.2	12.0	
	MT-12				8.2	-1.2	-0.2	32.6	0.0	-2.2	38.2	
	MT-13				8.0	-2.6	0.0	32.6	-0.6	-3.2	13.7	
	MT-14				9.0	-2.2	0.0	37.5	-0.4	-2.2	31.0	
	MT-15				8.8	-2.6	-0.8	38.4	-0.8	-3.0	14.1	

Appendix 2 a -- Compiled Phytotoxicity Data PT1 (2000)
Endpoint (Means)

Species	Sample	Shoot Dry Weight (g)	Root Dry Weight (g)	Total Dry Weight (g)	Total Dry Weight per Plant (g)
Dogwood	**MT-00**	0.181	0.082	0.262	0.033
	MT-01	0.241	0.084	0.326	0.040
	MT-02	0.158	0.042	0.200	0.024
	MT-03	0.191	0.068	0.259	0.035
	MT-04	0.349	0.094	0.444	0.066
	MT-05	0.065	0.019	0.085	0.015
	MT-06	0.000	0.000	0.000	0.000
	MT-07	0.168	0.071	0.239	0.031
	MT-08	0.133	0.037	0.170	0.022
	MT-09	0.146	0.045	0.191	0.029
	MT-10	0.000	0.000	0.000	0.000
	MT-11	0.198	0.059	0.258	0.029
	MT-12	0.211	0.081	0.293	0.033
	MT-13	0.201	0.066	0.267	0.029
	MT-14	0.334	0.132	0.466	0.054
	MT-15	0.122	0.036	0.158	0.019
Sedge	**MT-00**	0.026	0.072	0.098	0.014
	MT-01	0.012	0.008	0.019	0.002
	MT-02	0.009	0.005	0.014	0.002
	MT-03	0.013	0.044	0.058	0.008
	MT-04	0.078	0.069	0.147	0.017
	MT-05	0.006	0.008	0.014	0.002
	MT-06	0.000	0.000	0.000	0.000
	MT-07	0.008	0.011	0.020	0.002
	MT-08	0.009	0.010	0.019	0.002
	MT-09	0.008	0.020	0.028	0.004
	MT-10	0.000	0.000	0.000	0.000
	MT-11	0.008	0.010	0.018	0.002
	MT-12	0.007	0.010	0.017	0.002
	MT-13	0.006	0.011	0.017	0.002
	MT-14	0.009	0.008	0.017	0.002
	MT-15	0.010	0.028	0.038	0.004

Appendix 2 b -- Compiled Phytotoxicity Data PT2 (2001)
Endpoint (Means)

Species	Sample	Emergence Count	PE 7 Count	PE 7 Height	PE 7 Shoot Color	PE 7 Shoot Appearance	PE 14 Count	PE 14 Height	PE 14 Shoot Color	PE 14 Shoot Appearance	PE 21 Count	PE 21 Height
Alder	**Negative Control**		6.8	0.0	0.0	0.0	7.0	0.0	0.0	0.0		
	MT-01		7.6	0.0	0.0	0.0	7.4	-0.4	0.0	0.0		
	MT-02		6.0	0.0	0.0	0.0	5.8	-0.2	0.0	0.0		
	MT-03		4.8	0.0	0.0	0.0	4.6	-1.0	0.0	-0.6		
	MT-04		5.2	0.0	0.0	0.0	6.6	0.0	0.0	0.0		
	MT-05		5.4	-0.2	-0.2	0.0	4.2	-0.4	0.0	-0.4		
	MT-06		0.6	-2.0	-0.7	0.0	0.0	-4.0	-4.0	-4.0		
	MT-07		6.0	0.0	0.0	0.0	5.6	-0.4	-0.4	-0.4		
	MT-08		8.6	0.0	0.0	0.0	8.4	-0.8	0.0	-0.4		
	MT-09		5.8	-0.4	0.0	-0.2	5.2	-0.6	0.0	-1.0		
	MT-10		2.4	-2.0	-0.8	-0.5	0.0	-4.0	-4.0	-4.0		
	MT-11		8.6	-0.2	0.0	-0.2	7.0	-1.2	-0.8	-1.0		
	MT-12		6.4	0.0	0.0	0.0	7.8	-0.2	0.0	-0.2		
	MT-13		6.0	0.0	0.0	0.0	5.8	-1.5	0.0	-1.5		
	MT-14		8.4	0.0	0.0	0.0	8.0	0.0	0.0	0.0		
	MT-15		7.4	-0.4	0.0	0.0	7.2	-0.6	0.0	-0.2		
	Negative Control											
	MP-018											
	MP-019											
	MP-021											
	MP-022											
	MP-024											
	MP-033											
	MP-034											
	MP-035											
	MP-036											
	MP-042											
	MP-051											
	MP-053											
	MP-056											
	MP-057											
	MP-058											

Appendix 2 b -- Compiled Phytotoxicity Data PT2 (2001)
Endpoint (Means)

Species	Sample	PE 21 Shoot Color	PE 21 Shoot Appearance	Count	Shoot Color	Shoot Appearance	Mean Shoot Height (mm)	Root Color	Root Appearance	Mean Root Length (mm)	Mean Nodule Number	Shoot Dry Weight (g)
Alder	**Negative Control**			7.2	0.0	0.0	11.1	0.0	0.0	17.8		0.014
	MT-01			7.2	-1.8	0.0	9.8	-0.2	-1.8	27.5		0.012
	MT-02			5.8	-1.8	-0.8	11.1	-0.8	-1.8	16.8		0.010
	MT-03			4.6	-0.6	-0.4	11.4	-1.6	-1.6	33.0		0.006
	MT-04			5.8	-0.2	-0.4	18.1	-0.6	-1.4	23.9		0.016
	MT-05			4.0	-1.4	-1.6	11.6	-2.3	-3.5	10.8		0.004
	MT-06			0.0	-4.0	-4.0	-4.0	-4.0	-4.0	0.0		0.000
	MT-07			5.0	-1.2	-1.6	10.6	-0.8	-2.8	23.4		0.004
	MT-08			7.4	-1.6	-2.4	8.7	-0.4	-3.0	17.2		0.009
	MT-09			4.0	-1.6	-1.8	9.5	-0.8	-3.2	24.0		0.005
	MT-10			0.0	-4.0	-4.0	-4.0	-4.0	-4.0	0.0		0.000
	MT-11			5.6	-2.5	-2.5	9.8	-1.0	-3.5	10.0		0.012
	MT-12			7.4	-0.6	-0.6	11.3	-0.4	-1.0	27.6		0.010
	MT-13			4.6	-2.5	-2.3	7.5	-2.8	-3.0	11.5		0.006
	MT-14			7.8	-1.8	-2.0	10.4	-0.8	-1.8	25.8		0.010
	MT-15			7.0	-1.8	-2.4	9.2	-1.4	-3.2	11.3		0.009
	Negative Control			5.0	0.0	0.0	48.6	0.0	0.0	28.4		
	MP-018			5.0	-0.6	0.0	48.8	0.0	0.0	45.2		
	MP-019			5.0	-0.2	0.0	54.4	0.0	0.0	69.8		
	MP-021			5.0	0.0	0.0	58.0	0.0	0.0	72.4		
	MP-022			5.0	-0.4	0.0	49.8	0.0	0.0	98.2		
	MP-024			5.0	-0.2	0.0	37.2	0.0	0.0	92.4		
	MP-033			5.0	-0.4	0.0	61.4	0.0	0.0	78.8		
	MP-034			5.0	-0.2	-0.2	37.8	0.0	-0.8	64.2		
	MP-035			4.0	-3.8	-3.8	6.6	0.0	-4.0	-1.8		
	MP-036			5.0	-1.8	-0.8	44.2	0.0	0.0	56.4		
	MP-042			5.0	0.0	0.0	62.4	0.0	0.0	68.0		
	MP-051			5.0	-2.0	-1.8	2.8	0.0	-2.0	-1.8		
	MP-053			5.0	-2.6	-1.2	3.0	0.0	-2.4	-1.2		
	MP-056			5.0	-0.8	-0.2	20.0	0.0	-0.8	20.8		
	MP-057			5.0	-1.8	-1.4	36.0	0.0	-0.2	63.4		
	MP-058			5.0	-1.0	-0.2	10.8	0.0	-0.6	30.2		

Appendix 2 b -- Compiled Phytotoxicity Data PT2 (2001)
Endpoint (Means)

Species	Sample	Root Dry Weight (g)	Total Dry Weight (g)	Total Dry Weight per Plant (g)	Mean Net Growth - Leaf Number	Mean Net Growth - Branching
Alder	**Negative Control**	0.009	0.023	0.003		
	MT-01	0.007	0.019	0.003		
	MT-02	0.005	0.016	0.003		
	MT-03	0.005	0.011	0.002		
	MT-04	0.006	0.022	0.004		
	MT-05	0.002	0.007	0.002		
	MT-06	0.000	0.000	0.000		
	MT-07	0.002	0.006	0.001		
	MT-08	0.004	0.013	0.002		
	MT-09	0.003	0.008	0.002		
	MT-10	0.000	0.000	0.000		
	MT-11	0.008	0.021	0.003		
	MT-12	0.004	0.013	0.002		
	MT-13	0.002	0.008	0.001		
	MT-14	0.006	0.016	0.002		
	MT-15	0.002	0.011	0.002		
	Negative Control			5.432	15.4	0.8
	MP-018			4.034	16.0	0.6
	MP-019			4.812	17.0	0.2
	MP-021			5.531	15.0	1.6
	MP-022			4.531	16.0	1.0
	MP-024			4.778	15.0	1.6
	MP-033			3.948	22.6	0.8
	MP-034			4.228	25.2	1.4
	MP-035			0.916	-5.6	-0.2
	MP-036			3.641	16.8	1.2
	MP-042			2.919	16.0	1.2
	MP-051			1.983	2.4	0.0
	MP-053			1.513	-3.4	0.2
	MP-056			2.947	9.8	0.2
	MP-057			3.231	22.4	-0.2
	MP-058			2.939	14.6	-0.2

Appendix 2 b -- Compiled Phytotoxicity Data PT2 (2001)
Endpoint (Means)

Species	Sample	Emergence Count	PE 7 Count	PE 7 Height	PE 7 Shoot Color	PE 7 Shoot Appearance	PE 14 Count	PE 14 Height	PE 14 Shoot Color	PE 14 Shoot Appearance	PE 21 Count	PE 21 Height
	MP-059											
	MP-060											
	MP-062											
	MP-065											
	MP-066											
	MP-067											
	MP-068											
	MP-069											
	MP-070											
	MP-071											
	MP-072											
	MP-077											
	MP-078											
	MP-079											
	MP-100											
Alfalfa	**Negative Control**	13.8	13.8	0.0	0.0	0.0						
	MT-01	12.4	12.4	0.0	0.0	0.0						
	MT-02	10.8	10.2	-1.4	-1.4	0.0						
	MT-03	13.6	13.8	-1.6	-0.2	0.0						
	MT-04	13.0	13.2	-0.6	-0.2	0.0						
	MT-05	13.2	12.8	-2.2	-1.6	0.0						
	MT-06	0.0	0.0									
	MT-07	14.4	14.4	-1.6	-1.0	0.0						
	MT-08	14.0	13.8	-2.0	-1.4	0.0						
	MT-09	13.3	13.0	-1.0	-1.5	0.0						
	MT-10	0.0	0.0									
	MT-11	12.2	11.6	-2.6	-1.4	-0.3						
	MT-12	9.4	9.8	-1.8	-1.4	-0.2						
	MT-13	13.4	13.8	-1.8	-1.6	0.0						
	MT-14	13.6	13.6	-1.2	0.0	0.0						
	MT-15	13.6	12.4	-2.8	-1.0	-0.2						

Appendix 2 b -- Compiled Phytotoxicity Data PT2 (2001)
Endpoint (Means)

Species	Sample	PE 21 Shoot Color	PE 21 Shoot Appearance	Count	Shoot Color	Shoot Appearance	Mean Shoot Height (mm)	Root Color	Root Appearance	Mean Root Length (mm)	Mean Nodule Number	Shoot Dry Weight (g)
	MP-059			5.0	-1.8	-1.0	14.6	0.0	-1.0	16.0		
	MP-060			5.0	-1.4	-1.0	1.6	0.0	-2.0	0.2		
	MP-062			5.0	-1.2	-1.0	5.3	0.0	-1.6	25.8		
	MP-065			5.0	0.0	0.0	44.8	0.0	0.0	117.2		
	MP-066			0.0	-4.0	-3.4	0.0	-4.0	-4.0	-5.3		
	MP-067			5.0	-0.2	0.0	28.6	0.0	0.0	57.8		
	MP-068			5.0	0.0	0.0	25.8	0.0	0.0	36.6		
	MP-069			5.0	-1.4	-0.8	36.0	0.0	0.0	55.4		
	MP-070			5.0	-1.4	-1.2	7.6	0.0	-1.6	-5.0		
	MP-071			0.0	-4.0	-4.0	-3.4	-4.0	-4.0	-22.0		
	MP-072			5.0	0.0	0.0	32.0	0.0	0.0	31.4		
	MP-077			5.0	-1.2	-0.4	49.4	0.0	-0.8	-3.6		
	MP-078			5.0	-0.6	-0.2	58.4	0.0	0.0	33.0		
	MP-079			5.0	-1.4	-1.2	10.6	0.0	-1.4	-4.0		
	MP-100			5.0	0.0	0.0	45.2	0.0	0.0	45.6		
Alfalfa	**Negative Control**			13.8	0.0	0.0	54.0	0.0	0.0	83.1	2.5	0.184
	MT-01			12.2	0.0	0.0	81.6	0.0	0.0	99.6	2.5	0.234
	MT-02			10.8	-1.0	-0.2	43.8	-1.0	-1.0	43.6	0.0	0.105
	MT-03			13.8	0.0	0.0	55.8	0.0	0.0	111.5	1.7	0.105
	MT-04			13.0	0.0	0.0	88.1	0.0	0.0	116.1	2.0	0.310
	MT-05			12.4	-1.6	-0.6	33.2	-1.4	-1.4	59.1	0.3	0.097
	MT-06			0.0	-4.0	-4.0	-4.0	-4.0	-4.0	0.0	0.0	0.000
	MT-07			14.6	-1.0	0.0	49.6	-0.6	-0.4	87.7	0.8	0.120
	MT-08			14.0	-1.4	-0.4	36.9	-1.8	-2.0	52.3	0.0	0.087
	MT-09			13.5	-1.5	-0.3	47.5	-0.5	-0.5	72.0	1.0	0.132
	MT-10			0.0	-4.0	-4.0	-4.0	-4.0	-4.0	0.0	0.0	0.000
	MT-11			12.0	-1.2	-1.4	34.9	-1.0	-2.0	50.0	0.0	0.088
	MT-12			9.6	-2.6	-0.6	39.2	-1.0	-2.6	51.2	0.9	0.071
	MT-13			14.0	-2.4	-1.0	46.3	-1.0	-2.4	47.0	0.0	0.134
	MT-14			13.6	0.0	0.0	77.6	0.0	0.0	106.9	2.0	0.198
	MT-15			13.2	-1.8	-1.0	30.5	-1.2	-2.2	43.2	0.0	0.079

Appendix 2 b -- Compiled Phytotoxicity Data PT2 (2001)
Endpoint (Means)

Species	Sample	Root Dry Weight (g)	Total Dry Weight (g)	Total Dry Weight per Plant (g)	Mean Net Growth - Leaf Number	Mean Net Growth - Branching
	MP-059			3.099	16.0	0.6
	MP-060			2.377	8.4	-0.2
	MP-062			2.557	11.5	0.0
	MP-065			4.948	25.4	0.6
	MP-066			0.801	-15.5	-0.5
	MP-067			3.008	22.2	-0.4
	MP-068			4.318	13.8	-0.2
	MP-069			3.527	18.8	0.6
	MP-070			1.849	9.2	0.2
	MP-071			0.941	-20.0	-0.4
	MP-072			2.852	16.0	0.2
	MP-077			2.522	20.2	-0.4
	MP-078			2.884	15.4	0.2
	MP-079			1.885	10.0	0.8
	MP-100			3.038	15.6	0.2
Alfalfa	**Negative Control**	0.116	0.299	0.022		
	MT-01	0.053	0.286	0.024		
	MT-02	0.020	0.125	0.011		
	MT-03	0.057	0.162	0.012		
	MT-04	0.085	0.395	0.031		
	MT-05	0.024	0.121	0.010		
	MT-06	0.000	0.000	0.000		
	MT-07	0.041	0.161	0.011		
	MT-08	0.024	0.111	0.008		
	MT-09	0.035	0.167	0.012		
	MT-10	0.000	0.000	0.000		
	MT-11	0.024	0.113	0.009		
	MT-12	0.015	0.087	0.009		
	MT-13	0.019	0.153	0.011		
	MT-14	0.057	0.255	0.019		
	MT-15	0.024	0.103	0.008		

Appendix 2 b -- Compiled Phytotoxicity Data PT2 (2001)
Endpoint (Means)

Species	Sample	Emergence Count	PE 7 Count	PE 7 Height	PE 7 Shoot Color	PE 7 Shoot Appearance	PE 14 Count	PE 14 Height	PE 14 Shoot Color	PE 14 Shoot Appearance	PE 21 Count	PE 21 Height
	Negative Control	12.5	12.3	0.0	0.0	0.0						
	MP-018	14.4	14.2	-1.4	-0.2	-0.2						
	MP-019	13.6	13.4	-1.4	-0.4	0.0						
	MP-021	14.0	13.6	-2.8	-1.6	-0.2						
	MP-022	13.4	13.0	-0.6	-1.0	-0.2						
	MP-024	14.6	14.8	-2.0	-1.2	-0.4						
	MP-033	13.2	13.4	0.0	0.0	0.0						
	MP-034	12.8	12.6	-1.4	-0.4	-1.2						
	MP-035	3.8	1.8	-4.0	-1.6	-4.0						
	MP-036	12.0	11.0	-1.2	-0.8	-0.2						
	MP-042	12.4	12.4	-2.0	-0.6	-0.8						
	MP-051	11.6	11.0	-4.0	-2.0	-3.0						
	MP-053	2.8	1.4	-4.0	-3.0	-4.0						
	MP-056	13.4	13.4	-3.0	-1.8	-0.2						
	MP-057	10.6	10.4	-2.0	-1.4	0.0						
	MP-058	11.8	11.4	-2.8	-1.6	-0.4						
	MP-059	11.6	11.2	-2.8	-1.6	-0.4						
	MP-060	12.6	12.0	-4.0	-1.8	-2.8						
	MP-062	12.6	12.4	-3.8	-1.8	-2.8						
	MP-065	13.8	14.0	-0.6	-0.4	-0.2						
	MP-066	0.0	0.0	0.0	0.0	0.0						
	MP-067	12.8	12.2	-2.4	-0.8	0.0						
	MP-068	14.0	14.0	-1.0	-0.6	0.0						
	MP-069	14.2	14.2	-2.6	-1.6	-0.6						
	MP-070	12.8	12.2	-4.0	-1.0	-2.2						
	MP-071	0.0	0.0	0.0	0.0	0.0						
	MP-072	13.0	12.8	-1.0	-0.2	0.0						
	MP-077	14.4	14.6	-1.2	-1.3	0.0						
	MP-078	13.0	13.0	-2.8	-1.6	-0.2						
	MP-079	13.4	13.2	-3.8	-1.6	-2.8						
	MP-100	11.8	12.0	-1.8	-0.8	-0.6						

Appendix 2 b -- Compiled Phytotoxicity Data PT2 (2001)
Endpoint (Means)

Species	Sample	PE 21 Shoot Color	PE 21 Shoot Appearance	Count	Shoot Color	Shoot Appearance	Mean Shoot Height (mm)	Root Color	Root Appearance	Mean Root Length (mm)	Mean Nodule Number	Shoot Dry Weight (g)
	Negative Control			12.4	0.0	0.0	67.9	0.0	0.0	142.6	1.0	0.200
	MP-018			13.6	-2.0	0.0	49.8	-1.0	-1.0	104.1	0.0	0.148
	MP-019			13.4	-0.2	0.0	57.7	-1.0	-1.0	142.6	1.0	0.155
	MP-021			13.6	-1.8	0.0	44.8	-2.0	-2.0	82.0	0.1	0.096
	MP-022			13.4	-0.4	0.0	56.4	-1.0	-1.0	131.0	0.3	0.169
	MP-024			14.4	-1.2	-0.8	44.9	-1.0	-1.4	116.2	0.2	0.118
	MP-033			13.4	0.0	0.0	81.2	0.0	0.0	139.3	0.7	0.223
	MP-034			12.6	-0.4	0.0	53.3	-0.8	-1.2	128.6	0.6	0.129
	MP-035			1.0	-1.0	-4.0	12.6	0.0	-4.0	0.0	0.0	0.003
	MP-036			11.6	-0.8	0.0	49.6	-1.0	-2.0	102.4	0.0	0.111
	MP-042			12.4	-1.2	0.0	39.9	-2.0	-2.0	72.5	0.0	0.098
	MP-051			10.8	-2.0	-3.0	11.9	-3.0	-4.0	7.4	0.0	0.035
	MP-053			1.4	-4.0	-4.0	8.9	0.0	-4.0	0.0	0.0	0.002
	MP-056			13.2	-2.0	-3.0	21.3	-3.0	-4.0	11.3	0.0	0.069
	MP-057			10.2	-2.0	0.0	43.4	-1.4	-2.0	72.1	0.0	0.081
	MP-058			10.6	-2.0	-2.0	31.6	-3.0	-3.0	39.8	0.0	0.062
	MP-059			11.4	-2.0	-2.0	27.2	-2.0	-3.0	39.5	0.0	0.067
	MP-060			11.6	-2.0	-3.0	13.4	-2.0	-4.0	8.1	0.0	0.040
	MP-062			12.4	-2.0	-2.0	23.9	-1.8	-3.0	43.3	0.0	0.058
	MP-065			14.4	-0.4	-0.2	50.9	-0.2	-1.0	140.3	0.1	0.161
	MP-066			0.0	-4.0	-4.0	-4.0	-4.0	-4.0	0.0	0.0	0.000
	MP-067			12.4	-1.0	0.0	49.0	-1.0	-0.6	93.1	0.0	0.133
	MP-068			14.0	-0.8	-0.2	51.2	-1.0	-1.2	99.0	0.0	0.143
	MP-069			13.8	-1.8	-0.4	35.2	-1.6	-2.0	71.9	0.0	0.094
	MP-070			11.2	-3.0	-4.0	12.6	-3.0	-4.0	5.8	0.0	0.040
	MP-071			0.0	-4.0	-4.0	-4.0	-4.0	-4.0	0.0	0.0	0.000
	MP-072			12.8	-1.0	0.0	50.3	-0.6	-1.0	115.3	0.1	0.157
	MP-077			14.6	-0.6	0.0	51.1	-1.2	-1.0	91.8	0.0	0.171
	MP-078			12.6	-2.4	-1.0	36.3	-1.4	-2.6	85.9	0.0	0.086
	MP-079			12.8	-1.6	-2.2	20.1	-2.4	-3.8	14.1	0.0	0.059
	MP-100			11.4	-1.6	0.0	49.6	-0.2	-1.0	104.2	3.0	0.152

Appendix 2 b -- Compiled Phytotoxicity Data PT2 (2001)
Endpoint (Means)

Species	Sample	Root Dry Weight (g)	Total Dry Weight (g)	Total Dry Weight per Plant (g)	Mean Net Growth - Leaf Number	Mean Net Growth - Branching
	Negative Control	0.134	0.334	0.027		
	MP-018	0.104	0.252	0.019		
	MP-019	0.067	0.222	0.017		
	MP-021	0.046	0.142	0.010		
	MP-022	0.072	0.241	0.018		
	MP-024	0.059	0.176	0.012		
	MP-033	0.112	0.335	0.025		
	MP-034	0.071	0.200	0.016		
	MP-035	0.000	0.000	0.000		
	MP-036	0.057	0.168	0.014		
	MP-042	0.043	0.141	0.011		
	MP-051	0.006	0.040	0.004		
	MP-053	0.000	0.000	0.000		
	MP-056	0.026	0.095	0.007		
	MP-057	0.035	0.116	0.011		
	MP-058	0.023	0.085	0.008		
	MP-059	0.028	0.095	0.008		
	MP-060	0.012	0.052	0.005		
	MP-062	0.027	0.084	0.007		
	MP-065	0.089	0.250	0.017		
	MP-066	0.000	0.000	0.000		
	MP-067	0.074	0.207	0.016		
	MP-068	0.077	0.220	0.016		
	MP-069	0.078	0.172	0.012		
	MP-070	0.013	0.053	0.005		
	MP-071	0.000	0.000	0.000		
	MP-072	0.103	0.260	0.020		
	MP-077	0.076	0.246	0.017		
	MP-078	0.045	0.132	0.010		
	MP-079	0.028	0.087	0.007		
	MP-100	0.080	0.232	0.020		

Appendix 2 c -- Compiled Phytotoxicity Data PT3 (2001)
Alder

ID	Irrigation Type	Species	Treatment	Replicate	Harvest Count	Harvest Condition	Shoot Color Severity	Shoot Color	Shoot Appearance	Branch Length (mm) at Planting	Branch Length (mm) at Harvest	Net Branch Length (mm)
1	Surface	Alder	05cm	1	1	Alive	0	Brown	-4	108	106	-2
2	Surface	Alder	05cm	2	1	Alive	-4	Brown	-4	118	132	14
3	Surface	Alder	05cm	3	1	Alive	-1	Brown	0	107	112	5
4	Surface	Alder	15cm	1	1	Alive	0		0	100	231	131
5	Surface	Alder	15cm	2	1	Alive	0		0	121	142	21
6	Surface	Alder	15cm	3	1	Alive	-1	Brown	0	112	196	84
7	Surface	Alder	25cm	1	1	Alive	0		0	103	155	52
8	Surface	Alder	25cm	2	1	Alive	0		0	105	138	33
9	Surface	Alder	25cm	3	1	Alive	0		0	120	204	84
46	Subsurface	Alder	05cm	1	1	Dead	-4	Brown	-4	107	101	-6
47	Subsurface	Alder	05cm	2	1	Dead	-4	Brown	-4	115	115	0
48	Subsurface	Alder	05cm	3	1	Alive	-4	Brown	-4	105	107	2
49	Subsurface	Alder	15cm	1	1	Alive	0		0	133	223	90
50	Subsurface	Alder	15cm	2	1	Alive	0		0	105	160	55
51	Subsurface	Alder	15cm	3	1	Alive	-1	Brown	-1	86	135	49
52	Subsurface	Alder	25cm	1	1	Alive	-1	Brown	0	131	248	117
53	Subsurface	Alder	25cm	2	1	Alive	0		0	115	251	136
54	Subsurface	Alder	25cm	3	1	Alive	-1	Brown	-1	96	196	100

Appendix 2 c -- Compiled Phytotoxicity Data PT3 (2001)
Alder

ID	Irrigation Type	Species	Treatment	Root Color Severity	Root Color	Root Appearance	Root Length (mm) at Planting	Root Length (mm) at Harvest	Net Root Length (mm)	Wet Weight (g) Shoots	Wet Weight (g) Roots
1	Surface	Alder	05cm	-3	Dark	-3	198	195	-3	1.085	2.620
2	Surface	Alder	05cm	-3	Dark	-3	205	135	-70	0.952	3.707
3	Surface	Alder	05cm	-1	Brown	-1	210	210	0	6.572	16.637
4	Surface	Alder	15cm	0		0	205	251	46	7.364	12.958
5	Surface	Alder	15cm	0		0	207	230	23	5.858	11.330
6	Surface	Alder	15cm	0		-1	200	220	20	6.090	13.441
7	Surface	Alder	25cm	0		0	206	366	160	9.216	27.930
8	Surface	Alder	25cm	0		0	215	293	78	5.751	20.539
9	Surface	Alder	25cm	0		0	217	318	101	6.263	23.176
46	Subsurface	Alder	05cm	-3	Brown	-2	210	198	-12	0.571	2.338
47	Subsurface	Alder	05cm	-3	Brown	-2	198	192	-6	0.704	2.174
48	Subsurface	Alder	05cm	-3	Brown	-2	213	203	-10	1.216	4.504
49	Subsurface	Alder	15cm	0		-1	215	223	8	8.320	16.995
50	Subsurface	Alder	15cm	0		-1	204	204	0	4.977	8.480
51	Subsurface	Alder	15cm	0		-1	180	171	-9	4.860	8.482
52	Subsurface	Alder	25cm	0		0	185	256	71	4.908	16.492
53	Subsurface	Alder	25cm	0		0	202	260	58	7.525	11.312
54	Subsurface	Alder	25cm	0		0	194	295	101	7.146	12.142

Appendix 2 c -- Compiled Phytotoxicity Data PT3 (2001)
Alder

ID	Irrigation Type	Species	Treatment	Total Wet Weight (g)	Dry Weight (g) Shoots	Dry Weight (g)Roots	Total Dry Weight (g)	Total Dry Weight (g) per Plant	# Leaves at Planting	# Leaves at Harvest	Net Leaf Number
1	Surface	Alder	05cm	3.705	0.391	0.408	0.799	0.799	13	7	-6
2	Surface	Alder	05cm	4.659	0.361	1.475	1.836	1.836	16	6	-10
3	Surface	Alder	05cm	23.209	2.228	6.751	8.979	8.979	25	59	34
4	Surface	Alder	15cm	20.322	2.232	4.317	6.549	6.549	14	61	47
5	Surface	Alder	15cm	17.188	2.189	2.705	4.894	4.894	20	31	11
6	Surface	Alder	15cm	19.531	2.017	3.212	5.229	5.229	21	33	12
7	Surface	Alder	25cm	37.146	2.027	13.061	15.088	15.088	18	36	18
8	Surface	Alder	25cm	26.290	1.745	7.251	8.996	8.996	14	47	33
9	Surface	Alder	25cm	29.439	2.022	8.100	10.122	10.122	14	30	16
46	Subsurface	Alder	05cm	2.909	0.475	0.559	1.034	1.034	15	7	-8
47	Subsurface	Alder	05cm	2.878	0.275	0.223	0.498	0.498	13	9	-4
48	Subsurface	Alder	05cm	5.720	0.615	0.662	1.277	1.277	20	9	-11
49	Subsurface	Alder	15cm	25.315	2.667	3.653	6.320	6.320	22	37	15
50	Subsurface	Alder	15cm	13.457	1.392	1.518	2.910	2.910	18	30	12
51	Subsurface	Alder	15cm	13.342	1.435	2.156	3.591	3.591	21	32	11
52	Subsurface	Alder	25cm	21.400	2.444	5.690	8.134	8.134	16	76	60
53	Subsurface	Alder	25cm	18.837	1.902	3.246	5.148	5.148	18	51	33
54	Subsurface	Alder	25cm	19.288	2.190	2.998	5.188	5.188	17	34	17

Appendix 2 c -- Compiled Phytotoxicity Data PT3 (2001)
Alder

ID	Irrigation Type	Species	Treatment	# Secondary Branches at Planting	# Secondary Branches at Harvest	# Tertiary Branches at Planting	# Tertiary Branches at Harvest	Net Number of Branches at Harvest
1	Surface	Alder	05cm	2	2			0
2	Surface	Alder	05cm	4	4		1	1
3	Surface	Alder	05cm	4	4		0	0
4	Surface	Alder	15cm	2	3	1	2	2
5	Surface	Alder	15cm	3	3	1	0	-1
6	Surface	Alder	15cm	2	2		0	0
7	Surface	Alder	25cm	3	2	1	2	0
8	Surface	Alder	25cm	2	2		1	1
9	Surface	Alder	25cm	1	2		0	1
46	Subsurface	Alder	05cm	2	2		1	1
47	Subsurface	Alder	05cm	3	3	1		-1
48	Subsurface	Alder	05cm	2	2		1	1
49	Subsurface	Alder	15cm	2	2	2	0	-2
50	Subsurface	Alder	15cm	2	2		0	0
51	Subsurface	Alder	15cm	3	2		1	0
52	Subsurface	Alder	25cm	4	5	1	0	0
53	Subsurface	Alder	25cm	3	3		0	0
54	Subsurface	Alder	25cm	3	2		1	0

Appendix 2 c -- Compiled Phytotoxicity Data PT3 (2001)
Alfalfa

ID	Irrigation Type	Species	Treatment	Replicate	Harvest Count	Shoot Color Severity	Shoot Color	Shoot Appearance	Percentage at Harvest	Average Shoot Length (mm)	Root Color Severity	Root Color
10	Surface	Alfalfa	05cm	1	7	-1	Yellow	-3	1	71	0	
11	Surface	Alfalfa	05cm	2	3	0		-2	0	75	0	
12	Surface	Alfalfa	05cm	3	6	-2	Yellow	-2	1	47	0	
13	Surface	Alfalfa	15cm	1	7	-1	Yellow	-1	1	117	0	
14	Surface	Alfalfa	15cm	2	7	-2	Yellow/bro	-3	1	36	0	
15	Surface	Alfalfa	15cm	3	6	-1	Yellow	0	1	118	0	
16	Surface	Alfalfa	25cm	1	7	0		-2	1	87	0	
17	Surface	Alfalfa	25cm	2	6	-1	Yellow	-1	1	87	0	
18	Surface	Alfalfa	25cm	3	5	-1	Yellow	-2	1	51	0	
55	Subsurface	Alfalfa	05cm	1	4	-3	Yellow	-3	0	45	-1	Brown
56	Subsurface	Alfalfa	05cm	2	6	-3	Yellow/red	-3	1	42	-1	Brown
57	Subsurface	Alfalfa	05cm	3	7	-3	Yellow/red	-3	1	48	-1	Brown
58	Subsurface	Alfalfa	15cm	1	6	-1	Yellow	-1	1	65	0	
59	Subsurface	Alfalfa	15cm	2	8	-1	Brown/Yell	-1	1	76	0	
60	Subsurface	Alfalfa	15cm	3	7	-1	Yellow	-1	1	74	0	
61	Subsurface	Alfalfa	25cm	1	7	0		-1	1	78	0	
62	Subsurface	Alfalfa	25cm	2	9	0		0	1	99	0	
63	Subsurface	Alfalfa	25cm	3	9	-1	Yellow	-1	1	89	0	

ID	Irrigation Type	Species	Treatment	Root Appearance	Average Root Length (mm)	Average No. of Nodules	Wet Weight (g) Shoots	Wet Weight (g) Roots	Total Wet Weight (g)	Dry Weight (g) Shoots	Dry Weight (g) Roots
10	Surface	Alfalfa	05cm	-2	84	1	0.370	0.576	0.946	0.096	0.073
11	Surface	Alfalfa	05cm	-2	98	3	0.214	0.340	0.554	0.053	0.034
12	Surface	Alfalfa	05cm	-3	67	0	0.313	0.625	0.938	0.058	0.092
13	Surface	Alfalfa	15cm	-2	171	3	1.106	1.729	2.835	0.226	0.147
14	Surface	Alfalfa	15cm	-3	118	1	0.295	0.661	0.956	0.068	0.061
15	Surface	Alfalfa	15cm	-2	167	3	1.050	2.414	3.464	0.233	0.427
16	Surface	Alfalfa	25cm	-3	227	2	0.788	0.827	1.615	0.167	0.115
17	Surface	Alfalfa	25cm	-2	168	2	0.600	0.656	1.256	0.092	0.065
18	Surface	Alfalfa	25cm	-3	199	1	0.252	0.489	0.741	0.043	0.112
55	Subsurface	Alfalfa	05cm	-3	73	0	0.181	0.485	0.666	0.052	0.107
56	Subsurface	Alfalfa	05cm	-3	74	0	0.350	0.641	0.991	0.090	0.161
57	Subsurface	Alfalfa	05cm	-3	80	0	0.411	0.782	1.193	0.093	0.133
58	Subsurface	Alfalfa	15cm	-2	197	0	0.450	1.005	1.455	0.111	0.138
59	Subsurface	Alfalfa	15cm	-2	165	0	0.780	1.963	2.743	0.165	0.164
60	Subsurface	Alfalfa	15cm	-2	161	0	0.673	1.297	1.970	0.140	0.238
61	Subsurface	Alfalfa	25cm	-2	225	1	0.785	1.177	1.962	0.152	0.163
62	Subsurface	Alfalfa	25cm	-2	222	1	1.167	1.068	2.235	0.207	0.128
63	Subsurface	Alfalfa	25cm	-2	242	0	1.148	1.293	2.441	0.246	0.173

ID	Irrigation Type	Species	Treatment	Total Dry Weight (g)	Total Dry Weight (g) per Plant
10	Surface	Alfalfa	05cm	0.169	0.024
11	Surface	Alfalfa	05cm	0.087	0.029
12	Surface	Alfalfa	05cm	0.150	0.025
13	Surface	Alfalfa	15cm	0.373	0.053
14	Surface	Alfalfa	15cm	0.129	0.018
15	Surface	Alfalfa	15cm	0.660	0.110
16	Surface	Alfalfa	25cm	0.282	0.040
17	Surface	Alfalfa	25cm	0.157	0.026
18	Surface	Alfalfa	25cm	0.155	0.031
55	Subsurface	Alfalfa	05cm	0.159	0.040
56	Subsurface	Alfalfa	05cm	0.251	0.042
57	Subsurface	Alfalfa	05cm	0.226	0.032
58	Subsurface	Alfalfa	15cm	0.249	0.041
59	Subsurface	Alfalfa	15cm	0.329	0.041
60	Subsurface	Alfalfa	15cm	0.378	0.054
61	Subsurface	Alfalfa	25cm	0.315	0.045
62	Subsurface	Alfalfa	25cm	0.335	0.037
63	Subsurface	Alfalfa	25cm	0.419	0.047

ID	Irrigation Type	Species	Treatment	Replicate	Harvest Count	Harvest Condition	Shoot Color Severity	Shoot Color	Shoot Appearance	Branch Length (mm) at Planting	Branch Length (mm) at Harvest
19	Surface	Sedge	05cm	1	1	Alive	-2	Yellow/	-2	130	233
20	Surface	Sedge	05cm	2	1	Alive	-2	Yellow/	-2	172	175
21	Surface	Sedge	05cm	3	1	Alive	-2	Brown	-2	186	174
22	Surface	Sedge	15cm	1	1	Alive	-1	Yellow	0	149	156
23	Surface	Sedge	15cm	2	1	Alive	1	Yellow	0	128	135
24	Surface	Sedge	15cm	3	1	Alive	-1	Yellow	0	153	182
25	Surface	Sedge	25cm	1	1	Alive	0		0	133	185
26	Surface	Sedge	25cm	2	1	Alive	-1	Yellow	0	141	181
27	Surface	Sedge	25cm	3	1	Alive	-1	Yellow	0	155	147
64	Subsurface	Sedge	05cm	1	1	Alive	-3	Yellow/	-2	138	190
65	Subsurface	Sedge	05cm	2	1	Alive	-2	Yellow	0	152	247
66	Subsurface	Sedge	05cm	3	1	Alive	-3	Yellow/	-2	138	146
67	Subsurface	Sedge	15cm	1	1	Alive	-1	brown	0	135	405
68	Subsurface	Sedge	15cm	2	1	Alive	-1	brown	0	160	415
69	Subsurface	Sedge	15cm	3	1	Alive	-1	Brown	0	165	391
70	Subsurface	Sedge	25cm	1	1	Alive	0		0	165	474
71	Subsurface	Sedge	25cm	2	1	Alive	0		0	163	405
72	Subsurface	Sedge	25cm	3	1	Alive	0		0	136	419

ID	Irrigation Type	Species	Treatment	Net Branch Length (mm)	Root Color Severity	Root Color	Root Appearance	Root Length (mm) at Planting	Root Length (mm) at Harvest	Net Root Length (mm)	Wet Weight (g) Shoots
19	Surface	Sedge	05cm	103	0		0	175	168	-7	0.822
20	Surface	Sedge	05cm	3	0		0	202	111	-91	0.810
21	Surface	Sedge	05cm	-12	0		0	116	105	-11	1.083
22	Surface	Sedge	15cm	7	0		0	191	191	0	1.381
23	Surface	Sedge	15cm	7	0		0	163	231	68	0.829
24	Surface	Sedge	15cm	29	0		0	172	190	18	1.485
25	Surface	Sedge	25cm	52	0		0	181	321	140	1.891
26	Surface	Sedge	25cm	40	0		0	132	265	133	2.230
27	Surface	Sedge	25cm	-8	0		0	163	327	164	1.360
64	Subsurface	Sedge	05cm	52	0		-2	130	113	-17	0.729
65	Subsurface	Sedge	05cm	95	0		-2	141	136	-5	0.964
66	Subsurface	Sedge	05cm	8	0		-2	160	115	-45	0.677
67	Subsurface	Sedge	15cm	270	0		0	113	190	77	3.528
68	Subsurface	Sedge	15cm	255	0		0	180	164	-16	3.627
69	Subsurface	Sedge	15cm	226	0		0	110	160	50	3.388
70	Subsurface	Sedge	25cm	309	0		0	180	230	50	5.990
71	Subsurface	Sedge	25cm	242	0		0	140	206	66	3.004
72	Subsurface	Sedge	25cm	283	0		0	147	276	129	5.321

ID	Irrigation Type	Species	Treatment	Wet Weight (g) Roots	Total Wet Weight (g)	Dry Weight (g) Shoots	Dry Weight (g) Roots	Total Dry Weight (g)	Total Dry Weight (g) per Plant
19	Surface	Sedge	05cm	6.110	6.932	0.249	0.750	0.999	0.999
20	Surface	Sedge	05cm	9.799	10.609	0.220	1.166	1.386	1.386
21	Surface	Sedge	05cm	4.180	5.263	0.220	0.404	0.624	0.624
22	Surface	Sedge	15cm	9.620	11.001	0.387	1.275	1.662	1.662
23	Surface	Sedge	15cm	11.821	12.650	0.209	2.256	2.465	2.465
24	Surface	Sedge	15cm	16.809	18.294	0.361	2.320	2.681	2.681
25	Surface	Sedge	25cm	5.757	7.648	0.489	0.603	1.092	1.092
26	Surface	Sedge	25cm	9.913	12.143	0.612	2.093	2.705	2.705
27	Surface	Sedge	25cm	6.036	7.396	0.256	0.977	1.233	1.233
64	Subsurface	Sedge	05cm	1.637	2.366	0.250	0.569	0.819	0.819
65	Subsurface	Sedge	05cm	2.534	3.498	0.263	0.566	0.829	0.829
66	Subsurface	Sedge	05cm	3.506	4.183	0.261	0.534	0.795	0.795
67	Subsurface	Sedge	15cm	4.999	8.527	0.850	1.235	2.085	2.085
68	Subsurface	Sedge	15cm	5.902	9.529	0.857	0.981	1.838	1.838
69	Subsurface	Sedge	15cm	8.924	12.312	0.854	1.350	2.204	2.204
70	Subsurface	Sedge	25cm	5.104	11.094	1.261	1.319	2.580	2.580
71	Subsurface	Sedge	25cm	5.245	8.249	0.701	1.169	1.870	1.870
72	Subsurface	Sedge	25cm	8.201	13.522	1.371	2.342	3.713	3.713

Appendix 2 c -- Compiled Phytotoxicity Data PT3 (2001)
Wheat

ID	Irrigation Type	Species	Treatment	Replicate	Harvest Count	Shoot Color Severity	Shoot Color	Shoot Appearance	Percentage at Harvest	Average Shoot Length (mm)	Root Color Severity	Root Color
28	Surface	Wheat	05cm	1	7	-3	Yellow/	-2	1	290	0	
29	Surface	Wheat	05cm	2	9	-3	Yellow/	-2	1	317	0	
30	Surface	Wheat	05cm	3	5	-3	Yellow/	-2	1	387	0	
31	Surface	Wheat	15cm	1	7	-2	Yellow/	-2	1	375	0	
32	Surface	Wheat	15cm	2	9	-2	Yellow/	-2	1	275	0	
33	Surface	Wheat	15cm	3	8	-2	Yellow/	-2	1	302		
34	Surface	Wheat	25cm	1	8	-2	Yellow/	-2	1	290	0	
35	Surface	Wheat	25cm	2	8	-2	Yellow/	0	1	292	0	
36	Surface	Wheat	25cm	3	9	-2	Yellow/	-2	1	337	0	
73	Subsurface	Wheat	05cm	1	7	-3	Yellow/	-2	1	242	0	
74	Subsurface	Wheat	05cm	2	9	-3	Yellow/	-2	1	209	0	
75	Subsurface	Wheat	05cm	3	6	-3	Yellow/	-2	1	257	0	
76	Subsurface	Wheat	15cm	1	8	-2	Yellow/	0	1	440	0	
77	Subsurface	Wheat	15cm	2	8	-2	Yellow/	0	1	372	0	
78	Subsurface	Wheat	15cm	3	9	-2	Yellow/	0	1	435	0	
79	Subsurface	Wheat	25cm	1	7	-2	Yellow	0	1	469	0	
80	Subsurface	Wheat	25cm	2	8	-2	Yellow	0	1	495	0	
81	Subsurface	Wheat	25cm	3	7	-2	Yellow	0	1	385	0	

ID	Irrigation Type	Species	Treatment	Root Appearance	Longest Root Length (mm)	Wet Weight (g) Shoots	Wet Weight (g) Roots	Total Wet Weight (g)	Dry Weight (g) Shoots	Dry Weight (g) Roots
28	Surface	Wheat	05cm	-2	118	2	3	5.244	0.487	0.225
29	Surface	Wheat	05cm	-2	131	2	4	6.316	0.683	0.357
30	Surface	Wheat	05cm	-2	112	1	2	3.467	0.446	0.267
31	Surface	Wheat	15cm	0	248	2	4	6.536	0.641	0.588
32	Surface	Wheat	15cm	0	252	2	3	5.047	0.729	0.510
33	Surface	Wheat	15cm		245	2	4	6.756	0.723	0.254
34	Surface	Wheat	25cm	0	304	2	4	5.803	0.499	0.610
35	Surface	Wheat	25cm	0	275	2	4	6.251	0.544	0.735
36	Surface	Wheat	25cm	0	256	2	4	6.517	0.637	0.655
73	Subsurface	Wheat	05cm	-2	105	2	5	7.270	0.693	0.469
74	Subsurface	Wheat	05cm	-2	81	3	6	8.672	0.761	0.371
75	Subsurface	Wheat	05cm	-2	77	2	4	5.341	0.503	0.355
76	Subsurface	Wheat	15cm	0	199	9	11	20.230	2.534	1.725
77	Subsurface	Wheat	15cm	0	230	7	11	17.883	1.873	1.225
78	Subsurface	Wheat	15cm	0	218	8	10	17.968	2.321	1.525
79	Subsurface	Wheat	25cm	0	280	9	14	22.687	2.428	2.562
80	Subsurface	Wheat	25cm	0	283	11	14	24.807	2.801	1.941
81	Subsurface	Wheat	25cm	0	313	11	15	25.596	2.926	2.758

ID	Irrigation Type	Species	Treatment	Total Dry Weight (g)	Total Dry Weight (g) per Plant
28	Surface	Wheat	05cm	0.712	0.102
29	Surface	Wheat	05cm	1.040	0.116
30	Surface	Wheat	05cm	0.713	0.143
31	Surface	Wheat	15cm	1.229	0.176
32	Surface	Wheat	15cm	1.239	0.138
33	Surface	Wheat	15cm	0.977	0.122
34	Surface	Wheat	25cm	1.109	0.139
35	Surface	Wheat	25cm	1.279	0.160
36	Surface	Wheat	25cm	1.292	0.144
73	Subsurface	Wheat	05cm	1.162	0.166
74	Subsurface	Wheat	05cm	1.132	0.126
75	Subsurface	Wheat	05cm	0.858	0.143
76	Subsurface	Wheat	15cm	4.259	0.532
77	Subsurface	Wheat	15cm	3.098	0.387
78	Subsurface	Wheat	15cm	3.846	0.427
79	Subsurface	Wheat	25cm	4.990	0.713
80	Subsurface	Wheat	25cm	4.742	0.593
81	Subsurface	Wheat	25cm	5.684	0.812

Appendix 2 c -- Compiled Phytotoxicity Data PT3 (2001)
Willow

ID	Irrigation Type	Species	Treatment	Replicate	Harvest Count	Harvest Condition	Shoot Color Severity	Shoot Color	Shoot Appearance	Branch Length (mm) at Planting	Branch Length (mm) at Harvest
37	Surface	Willow	05cm	1	1	Alive	-3	Yellow/	-2	206	175
38	Surface	Willow	05cm	2	1	Alive	-3	Brown	-2	168	211
39	Surface	Willow	05cm	3	1	Alive	-3	Yellow/	-2	170	176
40	Surface	Willow	15cm	1	1	Alive	-2	Brown	-2	151	171
41	Surface	Willow	15cm	2	1	Alive	-2	Brown	-2	205	255
42	Surface	Willow	15cm	3	1	Alive	-3	Brown	-2	157	191
43	Surface	Willow	25cm	1	1	Alive	-3	Brown	-2	185	216
44	Surface	Willow	25cm	2	1	Alive	-2	Brown	-2	161	173
45	Surface	Willow	25cm	3	1	Alive	-2	Brown	-1	147	189
82	Subsurface	Willow	05cm	1	1	Alive	-2	Brown	0	171	331
83	Subsurface	Willow	05cm	2	1	Alive	-3	Brown	-2	159	225
84	Subsurface	Willow	05cm	3	1	Alive	-2	Brown	0	172	352
85	Subsurface	Willow	15cm	1	1	Alive	-1	Brown	0	148	328
86	Subsurface	Willow	15cm	2	1	Alive	-1	Brown	0	196	260
87	Subsurface	Willow	15cm	3	1	Alive	-1	Brown	0	164	332
88	Subsurface	Willow	25cm	1	1	Alive	-1	Yellow/	0	180	388
89	Subsurface	Willow	25cm	2	1	Alive	-1	Yellow	0	157	274
90	Subsurface	Willow	25cm	3	1	Alive	0		0	160	434

ID	Irrigation Type	Species	Treatment	Net Branch Length (mm)	Root Color Severity	Root Color	Root Appearance	Root Length (mm) at Planting	Root Length (mm) at Harvest	Net Root Length (mm)	Wet Weight (g) Shoots
37	Surface	Willow	05cm	-31	0		-2	195	200	5	23830.000
38	Surface	Willow	05cm	43	0		-2	198	189	-9	1.790
39	Surface	Willow	05cm	6	0		-2	205	201	-4	2.545
40	Surface	Willow	15cm	20	0		-1	197	255	58	2.994
41	Surface	Willow	15cm	50	0		-1	190	221	31	2.571
42	Surface	Willow	15cm	34	0		-1	195	188	-7	2.629
43	Surface	Willow	25cm	31	0		0	210	409	199	2.698
44	Surface	Willow	25cm	12	0		0	202	435	233	2.210
45	Surface	Willow	25cm	42	0		0	196	318	122	3.338
82	Subsurface	Willow	05cm	160	0		-1	199	190	-9	4.313
83	Subsurface	Willow	05cm	66	0		-1	196	198	2	3.358
84	Subsurface	Willow	05cm	180	0		-1	201	182	-19	4.850
85	Subsurface	Willow	15cm	180	0		0	200	218	18	6.202
86	Subsurface	Willow	15cm	64	0		0	191	292	101	6.775
87	Subsurface	Willow	15cm	168	0		0	197	238	41	7.912
88	Subsurface	Willow	25cm	208	0		0	195	320	125	6.734
89	Subsurface	Willow	25cm	117	0		0	209	271	62	6.017
90	Subsurface	Willow	25cm	274	0		0	197	322	125	9.496

Appendix 2 c -- Compiled Phytotoxicity Data PT3 (2001)
Willow

ID	Irrigation Type	Species	Treatment	Wet Weight (g) Roots	Total Wet Weight (g)	Dry Weight (g) Shoots	Dry Weight (g) Roots	Total Dry Weight (g)	Total Dry Weight (g) per Plant	# Leaves at Planting	# Leaves at Harvest
37	Surface	Willow	05cm	27.497	23857.496	1.308	3.916	5.224	5.224	16	34
38	Surface	Willow	05cm	30.933	32.723	0.753	4.133	4.886	4.886	26	14
39	Surface	Willow	05cm	69.200	71.745	1.403	12.158	13.561	13.561	15	21
40	Surface	Willow	15cm	36.088	39.082	1.399	5.361	6.760	6.760	23	31
41	Surface	Willow	15cm	39.158	41.729	1.300	6.404	7.704	7.704	9	27
42	Surface	Willow	15cm	38.192	40.821	1.203	7.115	8.318	8.318	30	37
43	Surface	Willow	25cm	47.096	49.794	1.317	8.583	9.900	9.900	20	25
44	Surface	Willow	25cm	26.258	28.468	1.053	4.120	5.173	5.173	21	28
45	Surface	Willow	25cm	52.471	55.809	1.628	11.512	13.140	13.140	34	38
82	Subsurface	Willow	05cm	37.749	42.062	1.574	8.407	9.981	9.981	19	36
83	Subsurface	Willow	05cm	42.642	46.000	1.459	7.970	9.429	9.429	17	33
84	Subsurface	Willow	05cm	45.574	50.424	1.794	7.585	9.379	9.379	19	47
85	Subsurface	Willow	15cm	61.919	68.121	2.318	11.121	13.439	13.439	15	52
86	Subsurface	Willow	15cm	53.553	60.328	2.661	10.615	13.276	13.276	22	104
87	Subsurface	Willow	15cm	63.229	71.141	2.938	12.507	15.445	15.445	42	120
88	Subsurface	Willow	25cm	66.848	73.582	2.560	14.176	16.736	16.736	29	78
89	Subsurface	Willow	25cm	39.605	45.622	2.170	8.436	10.606	10.606	21	67
90	Subsurface	Willow	25cm	74.753	84.249	3.598	9.902	13.500	13.500	25	121

Appendix 2 c -- Compiled Phytotoxicity Data PT3 (2001)
Willow

ID	Irrigation Type	Species	Treatment	Net Leaf Number	# Secoondary Branches at Planting	# Secondary Branches at Harvest	# Tertiary Branches at Planting	# Tertiary Branches at Harvest	Net Number of Branches at Harvest
37	Surface	Willow	05cm	18	2	3		2	3
38	Surface	Willow	05cm	-12	2	2	3	0	-3
39	Surface	Willow	05cm	6	2	1	2	2	-1
40	Surface	Willow	15cm	8	3	5	4	2	0
41	Surface	Willow	15cm	18	1	1		0	0
42	Surface	Willow	15cm	7	4	4	1	1	0
43	Surface	Willow	25cm	5	2	3		0	1
44	Surface	Willow	25cm	7	4	3		2	1
45	Surface	Willow	25cm	4	7	7	3	4	1
82	Subsurface	Willow	05cm	17	2	1	2	0	-3
83	Subsurface	Willow	05cm	16	3	3		1	1
84	Subsurface	Willow	05cm	28	4	3		1	0
85	Subsurface	Willow	15cm	37	2	3	1	2	2
86	Subsurface	Willow	15cm	82	5	10		1	6
87	Subsurface	Willow	15cm	78	5	6		0	1
88	Subsurface	Willow	25cm	49	4	5		2	3
89	Subsurface	Willow	25cm	46	4	5	2	3	2
90	Subsurface	Willow	25cm	96	5	4	2	5	2

Appendix 3 a -- Phytotox Scores 2000
Key

PE	**= Post Emergence**
Alder	
Alfalfa	
Dogwood	
Sedge	
	= not applicable
MT-00	**= Negative Control**

MT-01 through MT-15 are site samples

Appendix 3 a -- Phytotox Scores 2000
Endpoint (Means)

Species	Sample	Emergence Count	PE 7 Count	PE 7 Height	PE 7 Shoot Color	PE 7 Shoot Appearance	PE 14 Count	PE 14 Height	PE 14 Shoot Color	PE 14 Shoot Appearance	PE 21 Count
Alder	**MT-00**		6.8	0.0	0.0	0.0	7.0	0.0	0.0	0.0	
	MT-01		7.6	0.0	0.0	0.0	7.4	-0.4	0.0	0.0	
	MT-02		6.0	0.0	0.0	0.0	5.8	-0.2	0.0	0.0	
	MT-03		4.8	0.0	0.0	0.0	4.6	-1.0	0.0	-0.6	
	MT-04		5.2	0.0	0.0	0.0	6.6	0.0	0.0	0.0	
	MT-05		5.4	-0.2	-0.2	0.0	4.2	-0.4	0.0	-0.4	
	MT-06		0.6	-2.0	-0.7	0.0	0.0				
	MT-07		6.0	0.0	0.0	0.0	5.6	-0.4	-0.4	-0.4	
	MT-08		8.6	0.0	0.0	0.0	8.4	-0.8	0.0	-0.4	
	MT-09		5.8	-0.4	0.0	-0.2	5.2	-0.6	0.0	-1.0	
	MT-10		2.4	-2.0	-0.8	-0.5	0.0				
	MT-11		8.6	-0.2	0.0	-0.2	7.0	-1.2	-0.8	-1.0	
	MT-12		6.4	0.0	0.0	0.0	7.8	-0.2	0.0	-0.2	
	MT-13		6.0	0.0	0.0	0.0	5.8	-1.5	0.0	-1.5	
	MT-14		8.4	0.0	0.0	0.0	8.0	0.0	0.0	0.0	
	MT-15		7.4	-0.4	0.0	0.0	7.2	-0.6	0.0	-0.2	
Alfalfa	**MT-00**	13.8	13.8	0.0	0.0	0.0					
	MT-01	12.4	12.4	0.0	0.0	0.0					
	MT-02	10.8	10.2	-1.4	-1.4	0.0					
	MT-03	13.6	13.8	-1.6	-0.2	0.0					
	MT-04	13.0	13.2	-0.6	-0.2	0.0					
	MT-05	13.2	12.8	-2.2	-1.6	0.0					
	MT-06	0.0	0.0								
	MT-07	14.4	14.4	-1.6	-1.0	0.0					
	MT-08	14.0	13.8	-2.0	-1.4	0.0					
	MT-09	13.3	13.0	-1.0	-1.5	0.0					
	MT-10	0.0	0.0								
	MT-11	12.2	11.6	-2.6	-1.4	-0.3					
	MT-12	9.4	9.8	-1.8	-1.4	-0.2					
	MT-13	13.4	13.8	-1.8	-1.6	0.0					
	MT-14	13.6	13.6	-1.2	0.0	0.0					
	MT-15	13.6	12.4	-2.8	-1.0	-0.2					

Appendix 3 a -- Phytotox Scores 2000
Endpoint (Means)

Species	Sample	PE 21 Height	PE 21 Shoot Color	PE 21 Shoot Appearance	Count	Shoot Color	Shoot Appearance	Mean Shoot Height (mm)	Root Color	Root Appearance	Mean Root Length (mm)	Mean Nodule Number
Alder	**MT-00**				7.2	0.0	0.0	11.1	0.0	0.0	17.8	
	MT-01				7.2	-1.8	0.0	9.8	-0.2	-1.8	27.5	
	MT-02				5.8	-1.8	-0.8	11.1	-0.8	-1.8	16.8	
	MT-03				4.6	-0.6	-0.4	11.4	-1.6	-1.6	33.0	
	MT-04				5.8	-0.2	-0.4	18.1	-0.6	-1.4	23.9	
	MT-05				4.0	-1.4	-1.6	11.6	-2.3	-3.5	10.8	
	MT-06				0.0						0.0	
	MT-07				5.0	-1.2	-1.6	10.6	-0.8	-2.8	23.4	
	MT-08				7.4	-1.6	-2.4	8.7	-0.4	-3.0	17.2	
	MT-09				4.0	-1.6	-1.8	9.5	-0.8	-3.2	24.0	
	MT-10				0.0						0.0	
	MT-11				5.6	-2.5	-2.5	9.8	-1.0	-3.5	10.0	
	MT-12				7.4	-0.6	-0.6	11.3	-0.4	-1.0	27.6	
	MT-13				4.6	-2.5	-2.3	7.5	-2.8	-3.0	11.5	
	MT-14				7.8	-1.8	-2.0	10.4	-0.8	-1.8	25.8	
	MT-15				7.0	-1.8	-2.4	9.2	-1.4	-3.2	11.3	
Alfalfa	**MT-00**				13.8	0.0	0.0	54.0	0.0	0.0	83.1	2.5
	MT-01				12.2	0.0	0.0	81.6	0.0	0.0	99.6	2.5
	MT-02				10.8	-1.0	-0.2	43.8	-1.0	-1.0	43.6	0.0
	MT-03				13.8	0.0	0.0	55.8	0.0	0.0	111.5	1.7
	MT-04				13.0	0.0	0.0	88.1	0.0	0.0	116.1	2.0
	MT-05				12.4	-1.6	-0.6	33.2	-1.4	-1.4	59.1	0.3
	MT-06				0.0						0.0	0.0
	MT-07				14.6	-1.0	0.0	49.6	-0.6	-0.4	87.7	0.8
	MT-08				14.0	-1.4	-0.4	36.9	-1.8	-2.0	52.3	0.0
	MT-09				13.5	-1.5	-0.3	47.5	-0.5	-0.5	72.0	1.0
	MT-10				0.0						0.0	0.0
	MT-11				12.0	-1.2	-1.4	34.9	-1.0	-2.0	50.0	0.0
	MT-12				9.6	-2.6	-0.6	39.2	-1.0	-2.6	51.2	0.9
	MT-13				14.0	-2.4	-1.0	46.3	-1.0	-2.4	47.0	0.0
	MT-14				13.6	0.0	0.0	77.6	0.0	0.0	106.9	2.0
	MT-15				13.2	-1.8	-1.0	30.5	-1.2	-2.2	43.2	0.0

Appendix 3 a -- Phytotox Scores 2000
Endpoint (Means)

Species	Sample	Shoot Dry Weight (g)	Root Dry Weight (g)	Total Dry Weight (g)	Total Dry Weight per Plant (g)
Alder	**MT-00**	0.014	0.009	0.023	0.003
	MT-01	0.012	0.007	0.019	0.003
	MT-02	0.010	0.005	0.016	0.003
	MT-03	0.006	0.005	0.011	0.002
	MT-04	0.016	0.006	0.022	0.004
	MT-05	0.004	0.002	0.007	0.002
	MT-06	0.000	0.000	0.000	0.000
	MT-07	0.004	0.002	0.006	0.001
	MT-08	0.009	0.004	0.013	0.002
	MT-09	0.005	0.003	0.008	0.002
	MT-10	0.000	0.000	0.000	0.000
	MT-11	0.012	0.008	0.021	0.003
	MT-12	0.010	0.004	0.013	0.002
	MT-13	0.006	0.002	0.008	0.001
	MT-14	0.010	0.006	0.016	0.002
	MT-15	0.009	0.002	0.011	0.002
Alfalfa	**MT-00**	0.184	0.116	0.299	0.022
	MT-01	0.234	0.053	0.286	0.024
	MT-02	0.105	0.020	0.125	0.011
	MT-03	0.105	0.057	0.162	0.012
	MT-04	0.310	0.085	0.395	0.031
	MT-05	0.097	0.024	0.121	0.010
	MT-06	0.000	0.000	0.000	0.000
	MT-07	0.120	0.041	0.161	0.011
	MT-08	0.087	0.024	0.111	0.008
	MT-09	0.132	0.035	0.167	0.012
	MT-10	0.000	0.000	0.000	0.000
	MT-11	0.088	0.024	0.113	0.009
	MT-12	0.071	0.015	0.087	0.009
	MT-13	0.134	0.019	0.153	0.011
	MT-14	0.198	0.057	0.255	0.019
	MT-15	0.079	0.024	0.103	0.008

Appendix 3 a -- Phytotox Scores 2000
Endpoint (Means)

Species	Sample	Emergence Count	PE 7 Count	PE 7 Height	PE 7 Shoot Color	PE 7 Shoot Appearance	PE 14 Count	PE 14 Height	PE 14 Shoot Color	PE 14 Shoot Appearance	PE 21 Count
Dogwood	**MT-00**		7.6	0.0	0.0	0.0	8.2	0.0	0.0	0.0	8.0
	MT-01		7.2	-0.2	-0.2	-0.2	8.2	-0.8	-0.2	0.0	8.2
	MT-02		7.8	-0.2	0.0	-0.2	7.6	-0.6	-0.6	-0.4	8.0
	MT-03		7.8	-1.0	0.0	-0.4	7.8	-2.2	-0.2	-0.2	7.8
	MT-04		6.6	-0.8	0.0	-0.4	7.4	-1.0	0.0	-0.4	7.2
	MT-05		5.0	-1.6	-0.2	-1.0	6.8	-2.0	-1.0	-1.8	6.2
	MT-06		0.0				0.0				0.0
	MT-07		7.8	-0.6	0.0	-0.4	8.4	-1.2	-0.2	-0.4	7.8
	MT-08		7.4	-0.4	-0.4	-0.4	7.8	-1.0	-0.6	-0.8	7.2
	MT-09		6.2	-1.8	-0.5	-1.0	5.8	-2.0	-1.5	-0.8	5.4
	MT-10		0.0				1.2	-2.0	-3.0	0.0	0.0
	MT-11		9.0	-0.8	-0.2	-0.4	9.0	-1.6	-1.4	0.0	9.0
	MT-12		9.0	-0.4	-0.2	-0.2	9.0	-0.8	-0.6	0.0	8.8
	MT-13		8.3	-1.0	-0.2	-0.6	8.8	-2.0	-1.4	-0.6	9.0
	MT-14		8.8	-1.2	-0.2	-0.6	8.8	-1.8	0.0	-0.6	8.6
	MT-15		8.6	-2.0	-0.2	-0.8	8.2	-2.6	-1.2	-0.8	8.4
Sedge	**MT-00**		9.0	0.0	0.0	0.0	8.0	0.0	0.0	0.0	
	MT-01		9.0	-0.2	-0.6	0.0	8.6	-2.0	-1.0	0.0	
	MT-02		9.4	-0.2	-0.4	0.0	9.0	-2.4	-1.2	-0.4	
	MT-03		9.0	-0.2	-0.2	0.0	8.4	-1.2	-0.2	0.0	
	MT-04		9.0	0.0	-0.2	0.0	7.8	-0.6	0.0	0.0	
	MT-05		9.0	-0.2	-0.4	0.0	8.2	-2.2	-1.2	-0.4	
	MT-06		0.0				0.0				
	MT-07		9.0	0.0	0.0	0.0	9.0	-2.0	-0.8	0.0	
	MT-08		9.0	0.0	0.0	0.0	8.8	-1.2	-1.2	0.0	
	MT-09		9.0	0.0	-1.0	0.0	8.5	-1.8	-1.3	0.0	
	MT-10		3.6	-3.2	-3.0	0.0	0.0				
	MT-11		9.0	-0.2	-0.4	0.0	9.0	-3.0	-1.8	-0.2	
	MT-12		9.0	-0.8	-0.2	0.0	8.8	-2.8	-0.8	0.0	
	MT-13		9.0	-0.8	-0.2	0.0	8.8	-2.4	-1.4	-0.2	
	MT-14		9.0	-0.4	-0.2	0.0	9.0	-1.8	-0.8	0.0	
	MT-15		9.0	-0.2	-0.2	0.0	9.0	-1.8	-1.4	0.0	

Appendix 3 a -- Phytotox Scores 2000
Endpoint (Means)

Species	Sample	PE 21 Height	PE 21 Shoot Color	PE 21 Shoot Appearance	Count	Shoot Color	Shoot Appearance	Mean Shoot Height (mm)	Root Color	Root Appearance	Mean Root Length (mm)	Mean Nodule Number
Dogwood	**MT-00**	0.0	0.0	0.0	8.0	0.0	0.0	48.8	0.0	0.0	68.1	
	MT-01	-1.2	-0.4	-0.2	8.2	0.0	0.0	58.6	-0.4	0.0	73.8	
	MT-02	-1.8	-2.2	-0.6	8.2	-1.6	-0.4	40.3	-0.4	-2.2	32.6	
	MT-03	-2.4	-0.4	0.0	7.6	-0.6	0.0	51.3	-0.6	0.0	78.8	
	MT-04	-0.4	0.0	-0.4	6.8	0.0	0.0	78.7	-0.6	0.0	90.5	
	MT-05	-3.0	-1.8	-1.4	5.6	-2.0	-2.2	32.4	-0.8	-3.0	30.3	
	MT-06				0.0							
	MT-07	-2.2	-0.8	-0.2	7.8	-1.0	-1.2	46.6	-1.0	-0.6	63.6	
	MT-08	-2.0	-2.8	-0.4	7.6	-2.2	-2.6	38.7	-2.2	-2.8	40.9	
	MT-09	-2.0	-2.3	-1.0	5.4	-1.8	-0.8	47.6	-1.8	-1.0	58.2	
	MT-10				0.0							
	MT-11	-1.8	-2.8	-0.2	9.0	-1.0	-1.0	45.0	-2.0	-1.6	41.8	
	MT-12	-1.4	-2.2	0.0	8.8	-1.4	-0.6	49.6	-0.6	-0.6	61.7	
	MT-13	-1.6	-2.2	-0.8	9.0	-1.8	-0.6	51.0	-1.4	-0.4	55.4	
	MT-14	-0.4	0.0	-0.2	8.6	0.0	0.0	61.1	0.0	0.0	91.9	
	MT-15	-3.2	-2.8	-1.8	8.2	-3.0	-2.6	32.4	-2.6	-3.0	38.8	
Sedge	**MT-00**				7.0	0.0	0.0	64.7	0.0	0.0	75.9	
	MT-01				8.2	-2.0	-0.8	35.3	0.0	-1.2	31.5	
	MT-02				7.8	-1.8	-1.8	33.7	0.0	-2.2	15.3	
	MT-03				7.0	0.0	0.0	57.6	0.0	0.0	84.5	
	MT-04				7.6	0.0	0.0	53.6	0.0	-1.2	42.1	
	MT-05				6.4	-2.0	-1.0	32.2	-0.2	-2.6	21.0	
	MT-06				0.0						0.0	
	MT-07				8.6	-1.8	-0.4	46.2	0.0	-1.4	41.5	
	MT-08				8.4	-2.0	-1.0	40.0	0.0	-2.0	19.9	
	MT-09				5.4	-1.8	0.0	37.9	0.0	-2.3	34.6	
	MT-10				0.0						0.0	
	MT-11				8.2	-2.4	-0.4	35.7	-0.4	-3.2	12.0	
	MT-12				8.2	-1.2	-0.2	32.6	0.0	-2.2	38.2	
	MT-13				8.0	-2.6	0.0	32.6	-0.6	-3.2	13.7	
	MT-14				9.0	-2.2	0.0	37.5	-0.4	-2.2	31.0	
	MT-15				8.8	-2.6	-0.8	38.4	-0.8	-3.0	14.1	

Appendix 3 a -- Phytotox Scores 2000
Endpoint (Means)

Species	Sample	Shoot Dry Weight (g)	Root Dry Weight (g)	Total Dry Weight (g)	Total Dry Weight per Plant (g)
Dogwood	**MT-00**	0.181	0.082	0.262	0.033
	MT-01	0.241	0.084	0.326	0.040
	MT-02	0.158	0.042	0.200	0.024
	MT-03	0.191	0.068	0.259	0.035
	MT-04	0.349	0.094	0.444	0.066
	MT-05	0.065	0.019	0.085	0.015
	MT-06	0.000	0.000	0.000	0.000
	MT-07	0.168	0.071	0.239	0.031
	MT-08	0.133	0.037	0.170	0.022
	MT-09	0.146	0.045	0.191	0.029
	MT-10	0.000	0.000	0.000	0.000
	MT-11	0.198	0.059	0.258	0.029
	MT-12	0.211	0.081	0.293	0.033
	MT-13	0.201	0.066	0.267	0.029
	MT-14	0.334	0.132	0.466	0.054
	MT-15	0.122	0.036	0.158	0.019
Sedge	**MT-00**	0.026	0.072	0.098	0.014
	MT-01	0.012	0.008	0.019	0.002
	MT-02	0.009	0.005	0.014	0.002
	MT-03	0.013	0.044	0.058	0.008
	MT-04	0.078	0.069	0.147	0.017
	MT-05	0.006	0.008	0.014	0.002
	MT-06	0.000	0.000	0.000	0.000
	MT-07	0.008	0.011	0.020	0.002
	MT-08	0.009	0.010	0.019	0.002
	MT-09	0.008	0.020	0.028	0.004
	MT-10	0.000	0.000	0.000	0.000
	MT-11	0.008	0.010	0.018	0.002
	MT-12	0.007	0.010	0.017	0.002
	MT-13	0.006	0.011	0.017	0.002
	MT-14	0.009	0.008	0.017	0.002
	MT-15	0.010	0.028	0.038	0.004

Appendix 3 a -- Phytotox Scores 2000
% Values

Species	Sample	Emergence Count	PE 7 Count	PE 7 Height	PE 7 Shoot Color	PE 7 Shoot Appearance	PE 14 Count	PE 14 Height	PE 14 Shoot Color	PE 14 Shoot Appearance	PE 21 Count
Alder	**MT-00**										
	MT-01		0	0	0	0	0	1	0	0	
	MT-02		1	0	0	0	1	0	0	0	
	MT-03		1	0	0	0	1	1	0	1	
	MT-04		1	0	0	0	0	0	0	0	
	MT-05		1	0	0	0	1	1	0	1	
	MT-06		4	2	1	0	4				
	MT-07		1	0	0	0	1	1	1	1	
	MT-08		0	0	0	0	0	1	0	1	
	MT-09		1	1	0	0	1	1	0	1	
	MT-10		2	2	1	1	4				
	MT-11		0	0	0	0	0	1	1	1	
	MT-12		0	0	0	0	0	0	0	0	
	MT-13		1	0	0	0	1	1	0	1	
	MT-14		0	0	0	0	0	0	0	0	
	MT-15		0	1	0	0	0	1	0	0	
Alfalfa	**MT-00**										
	MT-01	1	1	0	0	0					
	MT-02	1	1	1	1	0					
	MT-03	0	0	1	0	0					
	MT-04	0	0	1	0	0					
	MT-05	0	0	2	1	0					
	MT-06	4	4								
	MT-07	0	0	1	1	0					
	MT-08	0	0	2	1	0					
	MT-09	0	0	1	1	0					
	MT-10	4	4								
	MT-11	1	1	2	1	0					
	MT-12	1	1	1	1	0					
	MT-13	0	0	1	1	0					
	MT-14	0	0	1	0	0					
	MT-15	0	1	2	1	0					

Appendix 3 a -- Phytotox Scores 2000
% Values

Species	Sample	PE 21 Height	PE 21 Shoot Color	PE 21 Shoot Appearance	% @ Harvest	Count	Shoot Color	Shoot Appearance	Mean Shoot Height (mm)	Root Color	Root Appearance	Mean Root Length (mm)
Alder	**MT-00**											
	MT-01					0	1	0	1	0	1	0
	MT-02					1	1	1	0	1	1	0
	MT-03					1	1	1	0	1	1	0
	MT-04					1	0	1	0	1	1	0
	MT-05					1	1	1	0	2	4	1
	MT-06					4			4			4
	MT-07					1	1	1	0	1	2	0
	MT-08					0	1	2	1	1	4	0
	MT-09					1	1	1	1	1	4	0
	MT-10					4			4			4
	MT-11					1	2	2	1	1	4	1
	MT-12					0	1	1	0	1	1	0
	MT-13					1	2	2	1	2	4	1
	MT-14					0	1	2	0	1	1	0
	MT-15					0	1	2	1	1	4	1
Alfalfa	**MT-00**											
	MT-01					1	0	0	0	0	0	0
	MT-02					1	1	0	1	1	1	1
	MT-03					0	0	0	0	0	0	0
	MT-04					0	0	0	0	0	0	0
	MT-05					1	1	1	1	1	1	1
	MT-06					4			4			4
	MT-07					0	1	0	0	1	1	0
	MT-08					0	1	1	1	1	2	1
	MT-09					0	1	0	1	1	1	1
	MT-10					4			4			4
	MT-11					1	1	1	1	1	2	1
	MT-12					1	2	1	1	1	2	1
	MT-13					0	2	1	1	1	2	1
	MT-14					0	0	0	0	0	0	0
	MT-15					0	1	1	1	1	2	1

Appendix 3 a -- Phytotox Scores 2000
% Values

Species	Sample	Mean Nodule Number	Shoot Wet Weight (g)	Root Wet Weight (g)	Total Wet Weight (g)	Shoot Dry Weight (g)	Root Dry Weight (g)	Total Dry Weight (g)	Total Dry Weight per Plant (g)
Alder	**MT-00**								
	MT-01					1	1	1	0
	MT-02					1	1	1	0
	MT-03					2	1	2	1
	MT-04					0	1	0	0
	MT-05					2	2	2	1
	MT-06					4	4	4	4
	MT-07					2	2	2	2
	MT-08					1	1	1	1
	MT-09					2	2	2	1
	MT-10					4	4	4	4
	MT-11					1	0	0	0
	MT-12					1	2	1	1
	MT-13					2	4	2	2
	MT-14					1	1	1	1
	MT-15					1	2	2	1
Alfalfa	**MT-00**								
	MT-01	0				0	2	0	0
	MT-02	4				1	4	2	1
	MT-03	1				1	2	1	1
	MT-04	1				0	1	0	0
	MT-05	4				1	4	2	2
	MT-06	4				4	4	4	4
	MT-07	2				1	2	1	1
	MT-08	4				2	4	2	2
	MT-09	2				1	2	1	1
	MT-10	4				4	4	4	4
	MT-11	4				2	4	2	2
	MT-12	2				2	4	2	2
	MT-13	4				1	4	1	1
	MT-14	1				0	2	1	1
	MT-15	4				2	4	2	2

Appendix 3 a -- Phytotox Scores 2000
% Values

Species	Sample	Emergence Count	PE 7 Count	PE 7 Height	PE 7 Shoot Color	PE 7 Shoot Appearance	PE 14 Count	PE 14 Height	PE 14 Shoot Color	PE 14 Shoot Appearance	PE 21 Count
Dogwood	**MT-00**										
	MT-01		0	0	0	0	0	1	0	0	0
	MT-02		0	0	0	0	0	1	1	1	0
	MT-03		0	1	0	1	0	2	0	0	0
	MT-04		1	1	0	1	0	1	0	1	1
	MT-05		1	1	0	1	1	2	1	1	1
	MT-06		4				4				4
	MT-07		0	1	0	1	0	1	0	1	0
	MT-08		0	1	1	1	0	1	1	1	1
	MT-09		1	1	1	1	1	2	1	1	1
	MT-10		4	0	0	0	4	2	4	0	4
	MT-11		0	1	0	1	0	1	1	0	0
	MT-12		0	1	0	0	0	1	1	0	0
	MT-13		0	1	0	1	0	2	1	1	0
	MT-14		0	1	0	1	0	1	0	1	0
	MT-15		0	2	0	1	0	2	1	1	0
Sedge	**MT-00**										
	MT-01		0	0	1	0	0	2	1	0	
	MT-02		0	0	1	0	0	2	1	1	
	MT-03		0	0	0	0	0	1	0	0	
	MT-04		0	0	0	0	0	1	0	0	
	MT-05		0	0	1	0	0	2	1	1	
	MT-06		4				4				
	MT-07		0	0	0	0	0	2	1	0	
	MT-08		0	0	0	0	0	1	1	0	
	MT-09		0	0	1	0	0	1	1	0	
	MT-10		2	4	4	0	4				
	MT-11		0	0	1	0	0	4	1	0	
	MT-12		0	1	0	0	0	2	1	0	
	MT-13		0	1	0	0	0	2	1	0	
	MT-14		0	1	0	0	0	1	1	0	
	MT-15		0	0	0	0	0	1	1	0	

Appendix 3 a -- Phytotox Scores 2000
% Values

Species	Sample	PE 21 Height	PE 21 Shoot Color	PE 21 Shoot Appearance	% @ Harvest	Count	Shoot Color	Shoot Appearance	Mean Shoot Height (mm)	Root Color	Root Appearance	Mean Root Length (mm)
Dogwood	**MT-00**											
	MT-01	1	1	0		0	0	0	0	1	0	0
	MT-02	1	2	1		0	1	1	1	1	2	2
	MT-03	2	1	0		0	1	0	0	1	0	0
	MT-04	1	0	1		1	0	0	0	1	0	0
	MT-05	4	1	1		1	2	2	1	1	4	2
	MT-06					4			4			4
	MT-07	2	1	0		0	1	1	0	1	1	0
	MT-08	2	2	1		0	2	2	1	2	2	1
	MT-09	2	2	1		1	1	1	0	1	1	1
	MT-10					4			4			4
	MT-11	1	2	0		0	1	1	0	2	1	1
	MT-12	1	2	0		0	1	1	0	1	1	0
	MT-13	1	2	1		0	1	1	0	1	1	1
	MT-14	1	0	0		0	0	0	0	0	0	0
	MT-15	4	2	1		0	4	2	1	2	4	1
Sedge	**MT-00**											
	MT-01					0	2	1	1	0	1	2
	MT-02					0	1	1	1	0	2	4
	MT-03					0	0	0	1	0	0	0
	MT-04					0	0	0	1	0	1	1
	MT-05					0	2	1	2	0	2	2
	MT-06					4			4			4
	MT-07					0	1	1	1	0	1	1
	MT-08					0	2	1	1	0	2	2
	MT-09					1	1	0	1	0	2	2
	MT-10					4			4			4
	MT-11					0	2	1	1	1	4	4
	MT-12					0	1	0	1	0	2	1
	MT-13					0	2	0	1	1	4	4
	MT-14					0	2	0	1	1	2	2
	MT-15					0	2	1	1	1	4	4

Appendix 3 a -- Phytotox Scores 2000
% Values

Species	Sample	Mean Nodule Number	Shoot Wet Weight (g)	Root Wet Weight (g)	Total Wet Weight (g)	Shoot Dry Weight (g)	Root Dry Weight (g)	Total Dry Weight (g)	Total Dry Weight per Plant (g)
Dogwood	**MT-00**								
	MT-01					0	0	0	0
	MT-02					1	1	1	1
	MT-03					0	1	0	0
	MT-04					0	0	0	0
	MT-05					2	4	2	2
	MT-06					4	4	4	4
	MT-07					0	1	0	0
	MT-08					1	2	1	1
	MT-09					1	1	1	1
	MT-10					4	4	4	4
	MT-11					0	1	0	1
	MT-12					0	0	0	0
	MT-13					0	1	0	1
	MT-14					0	0	0	0
	MT-15					1	2	1	1
Sedge	**MT-00**								
	MT-01					2	4	4	4
	MT-02					2	4	4	4
	MT-03					1	1	1	1
	MT-04					0	0	0	0
	MT-05					4	4	4	4
	MT-06					4	4	4	4
	MT-07					2	4	4	4
	MT-08					2	4	4	4
	MT-09					2	2	2	2
	MT-10					4	4	4	4
	MT-11					2	4	4	4
	MT-12					2	4	4	4
	MT-13					4	4	4	4
	MT-14					2	4	4	4
	MT-15					2	2	2	2

Appendix 3 a -- Phytotox Scores 2000
Scores

Sample	Emergence Count	PE 7 Count	PE 7 Height	PE 7 Shoot Color	PE 7 Shoot Appearance	PE 14 Count	PE 14 Height	PE 14 Shoot Color	PE 14 Shoot Appearance	PE 21 Count	PE 21 Height	PE 21 Shoot Color	PE 21 Shoot Appearance	Count	Shoot Color
MT-00															
MT-01		0	0	0	0	0	1	0	0					0	1
MT-02		1	0	0	0	1	0	0	0					1	1
MT-03		1	0	0	0	1	1	0	1					1	1
MT-04		1	0	0	0	0	0	0	0					1	0
MT-05		1	0	0	0	1	1	0	1					1	1
MT-06		4	2	1	0	4								4	
MT-07		1	0	0	0	1	1	1	1					1	1
MT-08		0	0	0	0	0	1	0	1					0	1
MT-09		1	1	0	0	1	1	0	1					1	1
MT-10		2	2	1	0	4								4	
MT-11		0	0	0	0	0	1	1	1					1	2
MT-12		0	0	0	0	0	0	0	0					0	1
MT-13		1	0	0	0	1	1	0	1					1	2
MT-14		0	0	0	0	0	0	0	0					0	1
MT-15		0	1	0	0	0	1	0	0					0	1
MT-00															
MT-01	1	1	0	0	0									1	0
MT-02	1	1	1	1	0									1	1
MT-03	0	0	1	0	0									0	0
MT-04	0	0	1	0	0									0	0
MT-05	0	0	2	1	0									1	1
MT-06	4	4												4	
MT-07	0	0	1	1	0									0	1
MT-08	0	0	2	1	0									0	1
MT-09	0	0	1	1	0									0	1
MT-10	4	4												4	
MT-11	1	1	2	1	0									1	1
MT-12	1	1	1	1	0									1	2
MT-13	0	0	1	1	0									0	2
MT-14	0	0	1	0	0									0	0
MT-15	0	1	2	1	0									0	1

Appendix 3 a -- Phytotox Scores 2000
Scores

Sample	Shoot Appearance	Mean Shoot Height (mm)	Root Color	Root Appearance	Mean Root Length (mm)	Mean Nodule Number	Shoot Wet Weight (g)	Root Wet Weight (g)	Total Wet Weight (g)	Shoot Dry Weight (g)	Root Dry Weight (g)	Total Dry Weight (g)	Total Dry Weight per Plant (g)	Mean
MT-00														
MT-01	0	1	0	1	0					1	1	1	0	0.24
MT-02	1	0	1	1	0					1	1	1	0	0.39
MT-03	1	0	1	1	0					2	1	2	1	0.68
MT-04	1	0	1	1	0					0	1	0	0	0.21
MT-05	1	0	2	4	1					2	2	2	1	1.03
MT-06		4			4					4	4	4	4	3.21
MT-07	1	0	1	2	0					2	2	2	2	0.84
MT-08	2	1	1	4	0					1	1	1	1	0.68
MT-09	1	1	1	4	0					2	2	2	1	0.97
MT-10		4			4					4	4	4	4	3.04
MT-11	2	1	1	4	1					1	0	0	0	0.74
MT-12	1	0	1	1	0					1	2	1	1	0.39
MT-13	2	1	2	4	1					2	4	2	2	1.37
MT-14	2	0	1	1	0					1	1	1	1	0.45
MT-15	2	1	1	4	1					1	2	2	1	0.87
MT-00														
MT-01	0	0	0	0	0	0				0	2	0	0	0.21
MT-02	0	1	1	1	1	4				1	4	2	1	1.21
MT-03	0	0	0	0	0	1				1	2	1	1	0.41
MT-04	0	0	0	0	0	1				0	1	0	0	0.12
MT-05	0	1	1	1	1	4				1	4	2	2	1.26
MT-06		4			4	4				4	4	4	4	4.00
MT-07	0	0	1	1	0	2				1	2	1	1	0.65
MT-08	0	1	1	2	1	4				2	4	2	2	1.35
MT-09	0	1	1	1	1	2				1	2	1	1	0.71
MT-10		4			4	4				4	4	4	4	4.00
MT-11	0	1	1	2	1	4				2	4	2	2	1.44
MT-12	0	1	1	2	1	2				2	4	2	2	1.41
MT-13	0	1	1	2	1	4				1	4	1	1	1.15
MT-14	0	0	0	0	0	1				0	2	1	1	0.26
MT-15	0	1	1	2	1	4				2	4	2	2	1.38

Appendix 3 a -- Phytotox Scores 2000
Scores

Sample	Emergence Count	PE 7 Count	PE 7 Height	PE 7 Shoot Color	PE 7 Shoot Appearance	PE 14 Count	PE 14 Height	PE 14 Shoot Color	PE 14 Shoot Appearance	PE 21 Count	PE 21 Height	PE 21 Shoot Color	PE 21 Shoot Appearance	Count	Shoot Color
MT-00															
MT-01		0	0	0	0	0	1	0	0	0	1	1	0	0	0
MT-02		0	0	0	0	0	1	1	1	0	1	2	1	0	1
MT-03		0	1	0	0	0	2	0	0	0	2	1	0	0	1
MT-04		1	1	0	0	0	1	0	1	1	1	0	1	1	0
MT-05		1	1	0	0	1	2	1	1	1	4	1	1	1	2
MT-06		4				4				4				4	
MT-07		0	1	0	0	0	1	0	1	0	2	1	0	0	1
MT-08		0	1	0	0	0	1	1	1	1	2	2	1	0	2
MT-09		1	1	0	0	1	2	1	1	1	2	2	1	1	1
MT-10		4				4	2	4	0	4				4	
MT-11		0	1	0	0	0	1	1	0	0	1	2	0	0	1
MT-12		0	1	0	0	0	1	1	0	0	1	2	0	0	1
MT-13		0	1	0	0	0	2	1	1	0	1	2	1	0	1
MT-14		0	1	0	0	0	1	0	1	0	1	0	0	0	0
MT-15		0	2	0	0	0	2	1	1	0	4	2	1	0	4
MT-00															
MT-01		0	0	0	0	0	2	1	0					0	2
MT-02		0	0	0	0	0	2	1	0					0	1
MT-03		0	0	0	0	0	1	0	0					0	0
MT-04		0	0	0	0	0	1	0	0					0	0
MT-05		0	0	0	0	0	2	1	0					0	2
MT-06		4				4								0	
MT-07		0	0	0	0	0	2	1	0					0	1
MT-08		0	0	0	0	0	1	1	0					0	2
MT-09		0	0	0	0	0	1	1	0					0	1
MT-10		2	4	0	0	4								0	
MT-11		0	0	0	0	0	4	1	0					0	2
MT-12		0	1	0	0	0	2	1	0					0	1
MT-13		0	1	0	0	0	2	1	0					0	2
MT-14		0	1	0	0	0	1	1	0					0	2
MT-15		0	0	0	0	0	1	1	0					0	2
	0.700	0.625	0.645	0.182	0.000	0.667	1.150	0.525	0.250	0.700	1.692	1.269	0.385	0.600	1.087

Appendix 3 a -- Phytotox Scores 2000
Scores

Sample	Shoot Appearance	Mean Shoot Height (mm)	Root Color	Root Appearance	Mean Root Length (mm)	Mean Nodule Number	Shoot Wet Weight (g)	Root Wet Weight (g)	Total Wet Weight (g)	Shoot Dry Weight (g)	Root Dry Weight (g)	Total Dry Weight (g)	Total Dry Weight per Plant (g)	Mean
MT-00														
MT-01	0	0	1	0	0					0	0	0	0	0.11
MT-02	1	1	1	2	2					1	1	1	1	0.63
MT-03	0	0	1	0	0					0	1	0	0	0.30
MT-04	0	0	1	0	0					0	0	0	0	0.22
MT-05	2	1	1	4	2					2	4	2	2	1.54
MT-06		4			4					4	4	4	4	4.00
MT-07	1	0	1	1	0					0	1	0	0	0.37
MT-08	2	1	2	2	1					1	2	1	1	0.96
MT-09	1	0	1	1	1					1	1	1	1	0.87
MT-10		4			4					4	4	4	4	3.54
MT-11	1	0	2	1	1					0	1	0	1	0.57
MT-12	1	0	1	1	0					0	0	0	0	0.30
MT-13	1	0	1	1	1					0	1	0	1	0.54
MT-14	0	0	0	0	0					0	0	0	0	0.13
MT-15	2	1	2	4	1					1	2	1	1	1.37
MT-00														
MT-01	1	1	0	1	2					2	4	4	4	1.24
MT-02	1	1	0	2	4					2	4	4	4	1.37
MT-03	0	1	0	0	0					1	1	1	1	0.29
MT-04	0	1	0	1	1					0	0	0	0	0.16
MT-05	1	2	0	2	2					4	4	4	4	1.47
MT-06		4			4					4	4	4	4	3.56
MT-07	1	1	0	1	1					2	4	4	4	1.11
MT-08	1	1	0	2	2					2	4	4	4	1.26
MT-09	0	1	0	2	2					2	2	2	2	0.84
MT-10		4			4					4	4	4	4	2.83
MT-11	1	1	1	4	4					2	4	4	4	1.63
MT-12	0	1	0	2	1					2	4	4	4	1.16
MT-13	0	1	1	4	4					4	4	4	4	1.63
MT-14	0	1	1	2	2					2	4	4	4	1.24
MT-15	1	1	1	4	4					2	2	2	2	1.16
	0.577	0.967	0.625	1.683	1.342	2.667				1.567	2.400	1.858	1.758	

Appendix 3 a -- Phytotox Scores 2000
Statistical Summary

Endpoint	Emergence Count	PE 7 Count	PE 7 Height	PE 7 Shoot Color	PE 7 Shoot Appearance	PE 14 Count	PE 14 Height	PE 14 Shoot Color	PE 14 Shoot Appearance
alder		0.0004	0.0000	0.0147	0.4543	0.0002	0.0017	0.0075	0.0061
alfalfa	0.0000	0.0000	0.0002	0.0004	0.5394				
dogwood		0.0046	0.0010	0.8120	0.1251	0.0015	0.0001	0.0035	0.0177
sedge		0.0000	0.0190	0.6007	1.0000	0.0000	0.0010	0.0064	0.2203

Endpoint		PE 21 Count	PE 21 Height	PE 21 Shoot Color	PE 21 Shoot Appearance	Count	Shoot Color	Shoot Appearance	Mean Shoot Height (mm)
alder						0.0248	0.0080	0.0008	0.0389
alfalfa						0.0057	0.0000	0.0856	0.0000
dogwood		0.0036	0.0000	0.0001	0.0164	0.0132	0.0001	0.0001	0.0000
sedge						0.2704	0.0030	0.0006	0.0001

Endpoint		Root Color	Root Appearance	Mean Root Length (mm)	Mean Nodule Number	Shoot Wet Weight (g)	Root Wet Weight (g)	Total Wet Weight (g)	
alder		0.0098	0.0000	0.0017		0.0012	0.0066	0.0030	
alfalfa		0.0001	0.0000	0.0000	0.0000	0.0000	0.0589	0.0001	
dogwood		0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	
sedge		0.0258	0.0001	0.0000		0.0002	0.0004	0.0002	

Endpoint		Shoot Dry Weight (g)	Root Dry Weight (g)	Total Dry Weight (g)	Total Dry Weight per Plant (g)
alder		0.0030	0.0166	0.0077	0.0121
alfalfa		0.0000	0.0001	0.0000	0.0000
dogwood		0.0001	0.0000	0.0001	0.0000
sedge		0.0080	0.0280	0.0205	0.0495

Appendix 3 a -- Phytotox Scores 2000
Summary

Sample ID	Alder	Alfalfa	Dogwood	Sedge	Means	Toxicity Categories
MT-01	0.24	0.21	0.11	1.24	0.45	Mildly Phytotoxic
MT-02	0.39	1.21	0.63	1.37	0.90	Moderately Phytotoxic
MT-03	0.68	0.41	0.30	0.29	0.42	Mildly Phytotoxic
MT-04	0.21	0.12	0.22	0.16	0.18	Mildly Phytotoxic
MT-05	1.03	1.26	1.54	1.47	1.33	Highly Phytotoxic
MT-06	3.21	4.00	4.00	3.56	3.69	Severely Phytotoxic
MT-07	0.84	0.65	0.37	1.11	0.74	Moderately Phytotoxic
MT-08	0.68	1.35	0.96	1.26	1.06	Highly Phytotoxic
MT-09	0.97	0.71	0.87	0.84	0.85	Moderately Phytotoxic
MT-10	3.04	4.00	3.54	2.83	3.35	Severely Phytotoxic
MT-11	0.74	1.44	0.57	1.63	1.09	Highly Phytotoxic
MT-12	0.39	1.41	0.30	1.16	0.82	Moderately Phytotoxic
MT-13	1.37	1.15	0.54	1.63	1.17	Highly Phytotoxic
MT-14	0.45	0.26	0.13	1.24	0.52	Moderately Phytotoxic
MT-15	0.87	1.38	1.37	1.16	1.19	Highly Phytotoxic
Means	1.01	1.30	1.03	1.40	1.18	

Toxicity Categories	Moderately Phytotc	Highly Phytotoxic	Highly Phytotoxic	Highly Phytotoxic

Emergence Count	PE 7 Count	PE 7 Height	PE 7 Shoot Color	PE 7 Shoot Appearance
0.70	0.63	0.65	0.18	0.12

	PE 14 Count	PE 14 Height	PE 14 Shoot Color	PE 14 Shoot Appearance
	0.67	1.15	0.53	0.28

	PE 21 Count	PE 21 Height	PE 21 Shoot Color	PE 21 Shoot Appearance
	0.70	1.69	1.27	0.38

#REF!	Count	Shoot Color	Shoot Appearance	Mean Shoot Height (mm)
#REF!	0.74	1.09	0.66	0.97

		Root Color	Root Appearance	Mean Root Length (mm)
		0.63	1.68	1.34

Mean Nodule Number	Shoot Dry Weight (g)	Root Dry Weight (g)	Total Dry Weight (g)	Total Dry Weight per Plant (g)
2.67	1.57	2.40	1.86	1.76

Appendix 3 b -- Phytotox Scores 2001
Key

PE	**= Post Emergence**
Alder	
Alfalfa	
	= not applicable
Neg.	**= Negative Control**

MP-18 through MT-1100 are site samples fro

Appendix 3 b -- Phytotox Scores 2001
Endpoint (Means)

Species	Sample	Emergence Count	PE 7 Count	PE 7 Height	PE 7 Shoot Color	PE 7 Shoot Appearance	PE 14 Count	PE 14 Height	PE 14 Shoot Color	PE 14 Shoot Appearance	PE 21 Count
Alder	**Negative Control**		6.8	0.0	0.0	0.0	7.0	0.0	0.0	0.0	
	MT-01		7.6	0.0	0.0	0.0	7.4	-0.4	0.0	0.0	
	MT-02		6.0	0.0	0.0	0.0	5.8	-0.2	0.0	0.0	
	MT-03		4.8	0.0	0.0	0.0	4.6	-1.0	0.0	-0.6	
	MT-04		5.2	0.0	0.0	0.0	6.6	0.0	0.0	0.0	
	MT-05		5.4	-0.2	-0.2	0.0	4.2	-0.4	0.0	-0.4	
	MT-06		0.6	-2.0	-0.7	0.0	0.0	-4.0	-4.0	-4.0	
	MT-07		6.0	0.0	0.0	0.0	5.6	-0.4	-0.4	-0.4	
	MT-08		8.6	0.0	0.0	0.0	8.4	-0.8	0.0	-0.4	
	MT-09		5.8	-0.4	0.0	-0.2	5.2	-0.6	0.0	-1.0	
	MT-10		2.4	-2.0	-0.8	-0.5	0.0	-4.0	-4.0	-4.0	
	MT-11		8.6	-0.2	0.0	-0.2	7.0	-1.2	-0.8	-1.0	
	MT-12		6.4	0.0	0.0	0.0	7.8	-0.2	0.0	-0.2	
	MT-13		6.0	0.0	0.0	0.0	5.8	-1.5	0.0	-1.5	
	MT-14		8.4	0.0	0.0	0.0	8.0	0.0	0.0	0.0	
	MT-15		7.4	-0.4	0.0	0.0	7.2	-0.6	0.0	-0.2	
	Negative Control										
	MP-018										
	MP-019										
	MP-021										
	MP-022										
	MP-024										
	MP-033										
	MP-034										
	MP-035										
	MP-036										
	MP-042										
	MP-051										
	MP-053										
	MP-056										
	MP-057										
	MP-058										

Appendix 3 b -- Phytotox Scores 2001
Endpoint (Means)

Species	Sample	PE 21 Height	PE 21 Shoot Color	PE 21 Shoot Appearance	Count	Shoot Color	Shoot Appearance	Mean Shoot Height (mm)	Root Color	Root Appearance	Mean Root Length (mm)
Alder	**Negative Control**				7.2	0.0	0.0	11.1	0.0	0.0	17.8
	MT-01				7.2	-1.8	0.0	9.8	-0.2	-1.8	27.5
	MT-02				5.8	-1.8	-0.8	11.1	-0.8	-1.8	16.8
	MT-03				4.6	-0.6	-0.4	11.4	-1.6	-1.6	33.0
	MT-04				5.8	-0.2	-0.4	18.1	-0.6	-1.4	23.9
	MT-05				4.0	-1.4	-1.6	11.6	-2.3	-3.5	10.8
	MT-06				0.0	-4.0	-4.0	-4.0	-4.0	-4.0	0.0
	MT-07				5.0	-1.2	-1.6	10.6	-0.8	-2.8	23.4
	MT-08				7.4	-1.6	-2.4	8.7	-0.4	-3.0	17.2
	MT-09				4.0	-1.6	-1.8	9.5	-0.8	-3.2	24.0
	MT-10				0.0	-4.0	-4.0	-4.0	-4.0	-4.0	0.0
	MT-11				5.6	-2.5	-2.5	9.8	-1.0	-3.5	10.0
	MT-12				7.4	-0.6	-0.6	11.3	-0.4	-1.0	27.6
	MT-13				4.6	-2.5	-2.3	7.5	-2.8	-3.0	11.5
	MT-14				7.8	-1.8	-2.0	10.4	-0.8	-1.8	25.8
	MT-15				7.0	-1.8	-2.4	9.2	-1.4	-3.2	11.3
	Negative Control				5.0	0.0	0.0	48.6	0.0	0.0	28.4
	MP-018				5.0	-0.6	0.0	48.8	0.0	0.0	45.2
	MP-019				5.0	-0.2	0.0	54.4	0.0	0.0	69.8
	MP-021				5.0	0.0	0.0	58.0	0.0	0.0	72.4
	MP-022				5.0	-0.4	0.0	49.8	0.0	0.0	98.2
	MP-024				5.0	-0.2	0.0	37.2	0.0	0.0	92.4
	MP-033				5.0	-0.4	0.0	61.4	0.0	0.0	78.8
	MP-034				5.0	-0.2	-0.2	37.8	0.0	-0.8	64.2
	MP-035				4.0	-3.8	-3.8	6.6	0.0	-4.0	-1.8
	MP-036				5.0	-1.8	-0.8	44.2	0.0	0.0	56.4
	MP-042				5.0	0.0	0.0	62.4	0.0	0.0	68.0
	MP-051				5.0	-2.0	-1.8	2.8	0.0	-2.0	-1.8
	MP-053				5.0	-2.6	-1.2	3.0	0.0	-2.4	-1.2
	MP-056				5.0	-0.8	-0.2	20.0	0.0	-0.8	20.8
	MP-057				5.0	-1.8	-1.4	36.0	0.0	-0.2	63.4
	MP-058				5.0	-1.0	-0.2	10.8	0.0	-0.6	30.2

Appendix 3 b -- Phytotox Scores 2001
Endpoint (Means)

Species	Sample	Mean Nodule Number	Shoot Dry Weight (g)	Root Dry Weight (g)	Total Dry Weight (g)	Total Dry Weight per Plant (g)
Alder	**Negative Control**		0.014	0.009	0.023	0.003
	MT-01		0.012	0.007	0.019	0.003
	MT-02		0.010	0.005	0.016	0.003
	MT-03		0.006	0.005	0.011	0.002
	MT-04		0.016	0.006	0.022	0.004
	MT-05		0.004	0.002	0.007	0.002
	MT-06		0.000	0.000	0.000	0.000
	MT-07		0.004	0.002	0.006	0.001
	MT-08		0.009	0.004	0.013	0.002
	MT-09		0.005	0.003	0.008	0.002
	MT-10		0.000	0.000	0.000	0.000
	MT-11		0.012	0.008	0.021	0.003
	MT-12		0.010	0.004	0.013	0.002
	MT-13		0.006	0.002	0.008	0.001
	MT-14		0.010	0.006	0.016	0.002
	MT-15		0.009	0.002	0.011	0.002
	Negative Control					5.432
	MP-018					4.034
	MP-019					4.812
	MP-021					5.531
	MP-022					4.531
	MP-024					4.778
	MP-033					3.948
	MP-034					4.228
	MP-035					0.916
	MP-036					3.641
	MP-042					2.919
	MP-051					1.983
	MP-053					1.513
	MP-056					2.947
	MP-057					3.231
	MP-058					2.939

Appendix 3 b -- Phytotox Scores 2001
Endpoint (Means)

Species	Sample	Emergence Count	PE 7 Count	PE 7 Height	PE 7 Shoot Color	PE 7 Shoot Appearance	PE 14 Count	PE 14 Height	PE 14 Shoot Color	PE 14 Shoot Appearance	PE 21 Count
	MP-059										
	MP-060										
	MP-062										
	MP-065										
	MP-066										
	MP-067										
	MP-068										
	MP-069										
	MP-070										
	MP-071										
	MP-072										
	MP-077										
	MP-078										
	MP-079										
	MP-100										
Alfalfa	**Negative Control**	13.8	13.8	0.0	0.0	0.0					
	MT-01	12.4	12.4	0.0	0.0	0.0					
	MT-02	10.8	10.2	-1.4	-1.4	0.0					
	MT-03	13.6	13.8	-1.6	-0.2	0.0					
	MT-04	13.0	13.2	-0.6	-0.2	0.0					
	MT-05	13.2	12.8	-2.2	-1.6	0.0					
	MT-06	0.0	0.0								
	MT-07	14.4	14.4	-1.6	-1.0	0.0					
	MT-08	14.0	13.8	-2.0	-1.4	0.0					
	MT-09	13.3	13.0	-1.0	-1.5	0.0					
	MT-10	0.0	0.0								
	MT-11	12.2	11.6	-2.6	-1.4	-0.3					
	MT-12	9.4	9.8	-1.8	-1.4	-0.2					
	MT-13	13.4	13.8	-1.8	-1.6	0.0					
	MT-14	13.6	13.6	-1.2	0.0	0.0					
	MT-15	13.6	12.4	-2.8	-1.0	-0.2					

Appendix 3 b -- Phytotox Scores 2001
Endpoint (Means)

Species	Sample	PE 21 Height	PE 21 Shoot Color	PE 21 Shoot Appearance	Count	Shoot Color	Shoot Appearance	Mean Shoot Height (mm)	Root Color	Root Appearance	Mean Root Length (mm)
	MP-059				5.0	-1.8	-1.0	14.6	0.0	-1.0	16.0
	MP-060				5.0	-1.4	-1.0	1.6	0.0	-2.0	0.2
	MP-062				5.0	-1.2	-1.0	5.3	0.0	-1.6	25.8
	MP-065				5.0	0.0	0.0	44.8	0.0	0.0	117.2
	MP-066				0.0	-4.0	-3.4	0.0	-4.0	-4.0	-5.3
	MP-067				5.0	-0.2	0.0	28.6	0.0	0.0	57.8
	MP-068				5.0	0.0	0.0	25.8	0.0	0.0	36.6
	MP-069				5.0	-1.4	-0.8	36.0	0.0	0.0	55.4
	MP-070				5.0	-1.4	-1.2	7.6	0.0	-1.6	-5.0
	MP-071				0.0	-4.0	-4.0	-3.4	-4.0	-4.0	-22.0
	MP-072				5.0	0.0	0.0	32.0	0.0	0.0	31.4
	MP-077				5.0	-1.2	-0.4	49.4	0.0	-0.8	-3.6
	MP-078				5.0	-0.6	-0.2	58.4	0.0	0.0	33.0
	MP-079				5.0	-1.4	-1.2	10.6	0.0	-1.4	-4.0
	MP-100				5.0	0.0	0.0	45.2	0.0	0.0	45.6
Alfalfa	**Negative Control**				13.8	0.0	0.0	54.0	0.0	0.0	83.1
	MT-01				12.2	0.0	0.0	81.6	0.0	0.0	99.6
	MT-02				10.8	-1.0	-0.2	43.8	-1.0	-1.0	43.6
	MT-03				13.8	0.0	0.0	55.8	0.0	0.0	111.5
	MT-04				13.0	0.0	0.0	88.1	0.0	0.0	116.1
	MT-05				12.4	-1.6	-0.6	33.2	-1.4	-1.4	59.1
	MT-06				0.0	-4.0	-4.0	-4.0	-4.0	-4.0	0.0
	MT-07				14.6	-1.0	0.0	49.6	-0.6	-0.4	87.7
	MT-08				14.0	-1.4	-0.4	36.9	-1.8	-2.0	52.3
	MT-09				13.5	-1.5	-0.3	47.5	-0.5	-0.5	72.0
	MT-10				0.0	-4.0	-4.0	-4.0	-4.0	-4.0	0.0
	MT-11				12.0	-1.2	-1.4	34.9	-1.0	-2.0	50.0
	MT-12				9.6	-2.6	-0.6	39.2	-1.0	-2.6	51.2
	MT-13				14.0	-2.4	-1.0	46.3	-1.0	-2.4	47.0
	MT-14				13.6	0.0	0.0	77.6	0.0	0.0	106.9
	MT-15				13.2	-1.8	-1.0	30.5	-1.2	-2.2	43.2

Appendix 3 b -- Phytotox Scores 2001
Endpoint (Means)

Species	Sample	Mean Nodule Number	Shoot Dry Weight (g)	Root Dry Weight (g)	Total Dry Weight (g)	Total Dry Weight per Plant (g)
	MP-059					3.099
	MP-060					2.377
	MP-062					2.557
	MP-065					4.948
	MP-066					0.801
	MP-067					3.008
	MP-068					4.318
	MP-069					3.527
	MP-070					1.849
	MP-071					0.941
	MP-072					2.852
	MP-077					2.522
	MP-078					2.884
	MP-079					1.885
	MP-100					3.038
Alfalfa	**Negative Control**	2.5	0.184	0.116	0.299	0.022
	MT-01	2.5	0.234	0.053	0.286	0.024
	MT-02	0.0	0.105	0.020	0.125	0.011
	MT-03	1.7	0.105	0.057	0.162	0.012
	MT-04	2.0	0.310	0.085	0.395	0.031
	MT-05	0.3	0.097	0.024	0.121	0.010
	MT-06	0.0	0.000	0.000	0.000	0.000
	MT-07	0.8	0.120	0.041	0.161	0.011
	MT-08	0.0	0.087	0.024	0.111	0.008
	MT-09	1.0	0.132	0.035	0.167	0.012
	MT-10	0.0	0.000	0.000	0.000	0.000
	MT-11	0.0	0.088	0.024	0.113	0.009
	MT-12	0.9	0.071	0.015	0.087	0.009
	MT-13	0.0	0.134	0.019	0.153	0.011
	MT-14	2.0	0.198	0.057	0.255	0.019
	MT-15	0.0	0.079	0.024	0.103	0.008

Appendix 3 b -- Phytotox Scores 2001
Endpoint (Means)

Species	Sample	Emergence Count	PE 7 Count	PE 7 Height	PE 7 Shoot Color	PE 7 Shoot Appearance	PE 14 Count	PE 14 Height	PE 14 Shoot Color	PE 14 Shoot Appearance	PE 21 Count
	Negative Control	12.5	12.3	0.0	0.0	0.0					

Appendix 3 b -- Phytotox Scores 2001
Endpoint (Means)

Species	Sample	PE 21 Height	PE 21 Shoot Color	PE 21 Shoot Appearance	Count	Shoot Color	Shoot Appearance	Mean Shoot Height (mm)	Root Color	Root Appearance	Mean Root Length (mm)
	Negative Control				12.4	0.0	0.0	67.9	0.0	0.0	142.6

Appendix 3 b -- Phytotox Scores 2001
Endpoint (Means)

Species	Sample	Mean Nodule Number	Shoot Dry Weight (g)	Root Dry Weight (g)	Total Dry Weight (g)	Total Dry Weight per Plant (g)
	Negative Control	1.0	0.200	0.134	0.334	0.027

Appendix 3 b -- Phytotox Scores 2001
Endpoint (Means)

Species	Sample	Emergence Count	PE 7 Count	PE 7 Height	PE 7 Shoot Color	PE 7 Shoot Appearance	PE 14 Count	PE 14 Height	PE 14 Shoot Color	PE 14 Shoot Appearance	PE 21 Count
	MP-018	14.4	14.2	-1.4	-0.2	-0.2					
	MP-019	13.6	13.4	-1.4	-0.4	0.0					
	MP-021	14.0	13.6	-2.8	-1.6	-0.2					
	MP-022	13.4	13.0	-0.6	-1.0	-0.2					
	MP-024	14.6	14.8	-2.0	-1.2	-0.4					
	MP-033	13.2	13.4	0.0	0.0	0.0					
	MP-034	12.8	12.6	-1.4	-0.4	-1.2					
	MP-035	3.8	1.8	-4.0	-1.6	-4.0					
	MP-036	12.0	11.0	-1.2	-0.8	-0.2					
	MP-042	12.4	12.4	-2.0	-0.6	-0.8					
	MP-051	11.6	11.0	-4.0	-2.0	-3.0					
	MP-053	2.8	1.4	-4.0	-3.0	-4.0					
	MP-056	13.4	13.4	-3.0	-1.8	-0.2					
	MP-057	10.6	10.4	-2.0	-1.4	0.0					
	MP-058	11.8	11.4	-2.8	-1.6	-0.4					
	MP-059	11.6	11.2	-2.8	-1.6	-0.4					
	MP-060	12.6	12.0	-4.0	-1.8	-2.8					
	MP-062	12.6	12.4	-3.8	-1.8	-2.8					
	MP-065	13.8	14.0	-0.6	-0.4	-0.2					
	MP-066	0.0	0.0	0.0	0.0	0.0					
	MP-067	12.8	12.2	-2.4	-0.8	0.0					
	MP-068	14.0	14.0	-1.0	-0.6	0.0					
	MP-069	14.2	14.2	-2.6	-1.6	-0.6					
	MP-070	12.8	12.2	-4.0	-1.0	-2.2					
	MP-071	0.0	0.0	0.0	0.0	0.0					
	MP-072	13.0	12.8	-1.0	-0.2	0.0					
	MP-077	14.4	14.6	-1.2	-1.3	0.0					
	MP-078	13.0	13.0	-2.8	-1.6	-0.2					
	MP-079	13.4	13.2	-3.8	-1.6	-2.8					
	MP-100	11.8	12.0	-1.8	-0.8	-0.6					

Appendix 3 b -- Phytotox Scores 2001
Endpoint (Means)

Species	Sample	PE 21 Height	PE 21 Shoot Color	PE 21 Shoot Appearance	Count	Shoot Color	Shoot Appearance	Mean Shoot Height (mm)	Root Color	Root Appearance	Mean Root Length (mm)
	MP-018				13.6	-2.0	0.0	49.8	-1.0	-1.0	104.1
	MP-019				13.4	-0.2	0.0	57.7	-1.0	-1.0	142.6
	MP-021				13.6	-1.8	0.0	44.8	-2.0	-2.0	82.0
	MP-022				13.4	-0.4	0.0	56.4	-1.0	-1.0	131.0
	MP-024				14.4	-1.2	-0.8	44.9	-1.0	-1.4	116.2
	MP-033				13.4	0.0	0.0	81.2	0.0	0.0	139.3
	MP-034				12.6	-0.4	0.0	53.3	-0.8	-1.2	128.6
	MP-035				1.0	-1.0	-4.0	12.6	0.0	-4.0	0.0
	MP-036				11.6	-0.8	0.0	49.6	-1.0	-2.0	102.4
	MP-042				12.4	-1.2	0.0	39.9	-2.0	-2.0	72.5
	MP-051				10.8	-2.0	-3.0	11.9	-3.0	-4.0	7.4
	MP-053				1.4	-4.0	-4.0	8.9	0.0	-4.0	0.0
	MP-056				13.2	-2.0	-3.0	21.3	-3.0	-4.0	11.3
	MP-057				10.2	-2.0	0.0	43.4	-1.4	-2.0	72.1
	MP-058				10.6	-2.0	-2.0	31.6	-3.0	-3.0	39.8
	MP-059				11.4	-2.0	-2.0	27.2	-2.0	-3.0	39.5
	MP-060				11.6	-2.0	-3.0	13.4	-2.0	-4.0	8.1
	MP-062				12.4	-2.0	-2.0	23.9	-1.8	-3.0	43.3
	MP-065				14.4	-0.4	-0.2	50.9	-0.2	-1.0	140.3
	MP-066				0.0	-4.0	-4.0	-4.0	-4.0	-4.0	0.0
	MP-067				12.4	-1.0	0.0	49.0	-1.0	-0.6	93.1
	MP-068				14.0	-0.8	-0.2	51.2	-1.0	-1.2	99.0
	MP-069				13.8	-1.8	-0.4	35.2	-1.6	-2.0	71.9
	MP-070				11.2	-3.0	-4.0	12.6	-3.0	-4.0	5.8
	MP-071				0.0	-4.0	-4.0	-4.0	-4.0	-4.0	0.0
	MP-072				12.8	-1.0	0.0	50.3	-0.6	-1.0	115.3
	MP-077				14.6	-0.6	0.0	51.1	-1.2	-1.0	91.8
	MP-078				12.6	-2.4	-1.0	36.3	-1.4	-2.6	85.9
	MP-079				12.8	-1.6	-2.2	20.1	-2.4	-3.8	14.1
	MP-100				11.4	-1.6	0.0	49.6	-0.2	-1.0	104.2

Appendix 3 b -- Phytotox Scores 2001
Endpoint (Means)

Species	Sample	Mean Nodule Number	Shoot Dry Weight (g)	Root Dry Weight (g)	Total Dry Weight (g)	Total Dry Weight per Plant (g)
	MP-018	0.0	0.148	0.104	0.252	0.019
	MP-019	1.0	0.155	0.067	0.222	0.017
	MP-021	0.1	0.096	0.046	0.142	0.010
	MP-022	0.3	0.169	0.072	0.241	0.018
	MP-024	0.2	0.118	0.059	0.176	0.012
	MP-033	0.7	0.223	0.112	0.335	0.025
	MP-034	0.6	0.129	0.071	0.200	0.016
	MP-035	0.0	0.003	0.000	0.000	0.000
	MP-036	0.0	0.111	0.057	0.168	0.014
	MP-042	0.0	0.098	0.043	0.141	0.011
	MP-051	0.0	0.035	0.006	0.040	0.004
	MP-053	0.0	0.002	0.000	0.000	0.000
	MP-056	0.0	0.069	0.026	0.095	0.007
	MP-057	0.0	0.081	0.035	0.116	0.011
	MP-058	0.0	0.062	0.023	0.085	0.008
	MP-059	0.0	0.067	0.028	0.095	0.008
	MP-060	0.0	0.040	0.012	0.052	0.005
	MP-062	0.0	0.058	0.027	0.084	0.007
	MP-065	0.1	0.161	0.089	0.250	0.017
	MP-066	0.0	0.000	0.000	0.000	0.000
	MP-067	0.0	0.133	0.074	0.207	0.016
	MP-068	0.0	0.143	0.077	0.220	0.016
	MP-069	0.0	0.094	0.078	0.172	0.012
	MP-070	0.0	0.040	0.013	0.053	0.005
	MP-071	0.0	0.000	0.000	0.000	0.000
	MP-072	0.1	0.157	0.103	0.260	0.020
	MP-077	0.0	0.171	0.076	0.246	0.017
	MP-078	0.0	0.086	0.045	0.132	0.010
	MP-079	0.0	0.059	0.028	0.087	0.007
	MP-100	3.0	0.152	0.080	0.232	0.020

Appendix 3 b -- Phytotox Scores 2001
% Values

Species	Sample	Emergence Count	PE 7 Count	PE 7 Height	PE 7 Shoot Color	PE 7 Shoot Appearance	PE 14 Count	PE 14 Height	PE 14 Shoot Color	PE 14 Shoot Appearance	PE 21 Count
Alder	MT-01		0	0	0	0	0	1	0	0	
Alder	MT-02		1	0	0	0	1	0	0	0	
Alder	MT-03		1	0	0	0	1	1	0	1	
Alder	MT-04		1	0	0	0	0	0	0	0	
Alder	MT-05		1	0	0	0	1	1	0	1	
Alder	MT-06		4	2	1	0	4	4	4	4	
Alder	MT-07		1	0	0	0	1	1	1	1	
Alder	MT-08		0	0	0	0	0	1	0	1	
Alder	MT-09		1	1	0	0	1	1	0	1	
Alder	MT-10		2	2	1	1	4	4	4	4	
Alder	MT-11		0	0	0	0	0	1	1	1	
Alder	MT-12		0	0	0	0	0	0	0	0	
Alder	MT-13		1	0	0	0	1	1	0	1	
Alder	MT-14		0	0	0	0	0	0	0	0	
Alder	MT-15		0	1	0	0	0	1	0	0	
Alder	MP-018										
Alder	MP-019										
Alder	MP-021										
Alder	MP-022										
Alder	MP-024										
Alder	MP-033										
Alder	MP-034										
Alder	MP-035										
Alder	MP-036										
Alder	MP-042										
Alder	MP-051										
Alder	MP-053										
Alder	MP-056										
Alder	MP-057										
Alder	MP-058										
Alder	MP-059										

Appendix 3 b -- Phytotox Scores 2001
% Values

Species	Sample	PE 21 Height	PE 21 Shoot Color	PE 21 Shoot Appearance	Count	Shoot Color	Shoot Appearance	Mean Shoot Height (mm)	Root Color	Root Appearance	Mean Root Length (mm)	Mean Nodule Number
Alder	MT-01				0	1	0	1	0	1	0	
Alder	MT-02				1	1	1	0	1	1	0	
Alder	MT-03				1	1	1	0	1	1	0	
Alder	MT-04				1	0	1	0	1	1	0	
Alder	MT-05				1	1	1	0	2	4	1	
Alder	MT-06				4	4	4	4	4	4	4	
Alder	MT-07				1	1	1	0	1	2	0	
Alder	MT-08				0	1	2	1	1	4	0	
Alder	MT-09				1	1	1	1	1	4	0	
Alder	MT-10				4	4	4	4	4	4	4	
Alder	MT-11				1	2	2	1	1	4	1	
Alder	MT-12				0	1	1	0	1	1	0	
Alder	MT-13				1	2	2	1	2	4	1	
Alder	MT-14				0	1	2	0	1	1	0	
Alder	MT-15				0	1	2	1	1	4	1	
Alder	MP-018				0	1	0	0	0	0	0	
Alder	MP-019				0	0	0	0	0	0	0	
Alder	MP-021				0	0	0	0	0	0	0	
Alder	MP-022				0	1	0	0	0	0	0	
Alder	MP-024				0	0	0	1	0	0	0	
Alder	MP-033				0	1	0	0	0	0	0	
Alder	MP-034				0	0	0	1	0	1	0	
Alder	MP-035				1	4	4	4	0	4	4	
Alder	MP-036				0	1	1	0	0	0	0	
Alder	MP-042				0	0	0	0	0	0	0	
Alder	MP-051				0	2	1	4	0	2	4	
Alder	MP-053				0	2	1	4	0	2	4	
Alder	MP-056				0	1	0	2	0	1	1	
Alder	MP-057				0	1	1	1	0	0	0	
Alder	MP-058				0	1	0	4	0	1	0	
Alder	MP-059				0	1	1	2	0	1	1	

Appendix 3 b -- Phytotox Scores 2001
% Values

Species	Sample	Shoot Dry Weight (g)	Root Dry Weight (g)	Total Dry Weight (g)	Total Dry Weight per Plant (g)	Mean Net Growth - Leaf Number	Mean Net Growth - Branching
Alder	MT-01	1	1	1	0		
Alder	MT-02	1	1	1	0		
Alder	MT-03	2	1	2	1		
Alder	MT-04	0	1	0	0		
Alder	MT-05	2	2	2	1		
Alder	MT-06	4	4	4	4		
Alder	MT-07	2	2	2	2		
Alder	MT-08	1	1	1	1		
Alder	MT-09	2	2	2	1		
Alder	MT-10	4	4	4	4		
Alder	MT-11	1	0	0	0		
Alder	MT-12	1	2	1	1		
Alder	MT-13	2	4	2	2		
Alder	MT-14	1	1	1	1		
Alder	MT-15	1	2	2	1		
Alder	MP-018				1	1	0
Alder	MP-019				1	4	0
Alder	MP-021				0	0	0
Alder	MP-022				1	0	0
Alder	MP-024				1	0	0
Alder	MP-033				1	0	0
Alder	MP-034				1	0	0
Alder	MP-035				4	4	4
Alder	MP-036				1	0	0
Alder	MP-042				1	0	0
Alder	MP-051				2	4	4
Alder	MP-053				2	4	4
Alder	MP-056				1	4	1
Alder	MP-057				1	4	0
Alder	MP-058				1	4	0
Alder	MP-059				1	1	0

Appendix 3 b -- Phytotox Scores 2001
% Values

Species	Sample	Emergence Count	PE 7 Count	PE 7 Height	PE 7 Shoot Color	PE 7 Shoot Appearance	PE 14 Count	PE 14 Height	PE 14 Shoot Color	PE 14 Shoot Appearance	PE 21 Count
Alder	MP-060										
Alder	MP-062										
Alder	MP-065										
Alder	MP-066										
Alder	MP-067										
Alder	MP-068										
Alder	MP-069										
Alder	MP-070										
Alder	MP-071										
Alder	MP-072										
Alder	MP-077										
Alder	MP-078										
Alder	MP-079										
Alder	MP-100										
Alfalfa	MT-01	1	1	0	0	0					
Alfalfa	MT-02	1	1	1	1	0					
Alfalfa	MT-03	0	0	1	0	0					
Alfalfa	MT-04	0	0	1	0	0					
Alfalfa	MT-05	0	0	2	1	0					
Alfalfa	MT-06	4	4	0	0	0					
Alfalfa	MT-07	0	0	1	1	0					
Alfalfa	MT-08	0	0	2	1	0					
Alfalfa	MT-09	0	0	1	1	0					
Alfalfa	MT-10	4	4	0	0	0					
Alfalfa	MT-11	1	1	2	1	0					
Alfalfa	MT-12	1	1	1	1	0					
Alfalfa	MT-13	0	0	1	1	0					
Alfalfa	MT-14	0	0	1	0	0					
Alfalfa	MT-15	0	1	2	1	0					
Alfalfa	MP-018	0	0	1	0	0					
Alfalfa	MP-019	0	0	1	1	0					
Alfalfa	MP-021	0	0	2	1	0					
Alfalfa	MP-022	0	0	1	1	0					

Appendix 3 b -- Phytotox Scores 2001
% Values

Species	Sample	PE 21 Height	PE 21 Shoot Color	PE 21 Shoot Appearance	Count	Shoot Color	Shoot Appearance	Mean Shoot Height (mm)	Root Color	Root Appearance	Mean Root Length (mm)	Mean Nodule Number
Alder	MP-060				0	1	1	4	0	2	4	
Alder	MP-062				0	1	1	4	0	1	0	
Alder	MP-065				0	0	0	0	0	0	0	
Alder	MP-066				4	4	4	4	4	4	4	
Alder	MP-067				0	0	0	1	0	0	0	
Alder	MP-068				0	0	0	1	0	0	0	
Alder	MP-069				0	1	1	1	0	0	0	
Alder	MP-070				0	1	1	4	0	1	4	
Alder	MP-071				4	4	4	4	4	4	4	
Alder	MP-072				0	0	0	1	0	0	0	
Alder	MP-077				0	1	1	0	0	1	4	
Alder	MP-078				0	1	0	0	0	0	0	
Alder	MP-079				0	1	1	4	0	1	4	
Alder	MP-100				0	0	0	0	0	0	0	
Alfalfa	MT-01				1	0	0	0	0	0	0	0
Alfalfa	MT-02				1	1	0	1	1	1	1	4
Alfalfa	MT-03				0	0	0	0	0	0	0	1
Alfalfa	MT-04				0	0	0	0	0	0	0	1
Alfalfa	MT-05				1	1	1	1	1	1	1	4
Alfalfa	MT-06				4	4	4	4	4	4	4	4
Alfalfa	MT-07				0	1	0	0	1	1	0	2
Alfalfa	MT-08				0	1	1	1	1	2	1	4
Alfalfa	MT-09				0	1	0	1	1	1	1	2
Alfalfa	MT-10				4	4	4	4	4	4	4	4
Alfalfa	MT-11				1	1	1	1	1	2	1	4
Alfalfa	MT-12				1	2	1	1	1	2	1	2
Alfalfa	MT-13				0	2	1	1	1	2	1	4
Alfalfa	MT-14				0	0	0	0	0	0	0	1
Alfalfa	MT-15				0	1	1	1	1	2	1	4
Alfalfa	MP-018				0	2	0	1	1	1	1	4
Alfalfa	MP-019				0	0	0	1	1	1	0	0
Alfalfa	MP-021				0	1	0	1	2	2	1	4
Alfalfa	MP-022				0	1	0	1	1	1	0	2

Appendix 3 b -- Phytotox Scores 2001
% Values

Species	Sample	Shoot Dry Weight (g)	Root Dry Weight (g)	Total Dry Weight (g)	Total Dry Weight per Plant (g)	Mean Net Growth - Leaf Number	Mean Net Growth - Branching
Alder	MP-060				2	4	1
Alder	MP-062				2	4	1
Alder	MP-065				0	1	0
Alder	MP-066				4	4	4
Alder	MP-067				1	4	0
Alder	MP-068				1	4	1
Alder	MP-069				1	1	0
Alder	MP-070				2	4	1
Alder	MP-071				4	4	4
Alder	MP-072				1	4	0
Alder	MP-077				2	4	0
Alder	MP-078				1	4	0
Alder	MP-079				2	0	1
Alder	MP-100				1	4	0
Alfalfa	MT-01	0	2	0	0		
Alfalfa	MT-02	1	4	2	1		
Alfalfa	MT-03	1	2	1	1		
Alfalfa	MT-04	0	1	0	0		
Alfalfa	MT-05	1	4	2	2		
Alfalfa	MT-06	4	4	4	4		
Alfalfa	MT-07	1	2	1	1		
Alfalfa	MT-08	2	4	2	2		
Alfalfa	MT-09	1	2	1	1		
Alfalfa	MT-10	4	4	4	4		
Alfalfa	MT-11	2	4	2	2		
Alfalfa	MT-12	2	4	2	2		
Alfalfa	MT-13	1	4	1	1		
Alfalfa	MT-14	0	2	1	1		
Alfalfa	MT-15	2	4	2	2		
Alfalfa	MP-018	1	1	1	1		
Alfalfa	MP-019	1	1	1	1		
Alfalfa	MP-021	2	2	2	2		
Alfalfa	MP-022	1	1	1	1		

Appendix 3 b -- Phytotox Scores 2001
% Values

Species	Sample	Emergence Count	PE 7 Count	PE 7 Height	PE 7 Shoot Color	PE 7 Shoot Appearance	PE 14 Count	PE 14 Height	PE 14 Shoot Color	PE 14 Shoot Appearance	PE 21 Count
Alfalfa	MP-024	0	0	2	1	1					
Alfalfa	MP-033	0	0	0	0	0					
Alfalfa	MP-034	0	0	1	1	1					
Alfalfa	MP-035	2	4	4	1	4					
Alfalfa	MP-036	0	1	1	1	0					
Alfalfa	MP-042	0	0	2	1	1					
Alfalfa	MP-051	0	1	4	2	4					
Alfalfa	MP-053	4	4	4	4	4					
Alfalfa	MP-056	0	0	4	1	0					
Alfalfa	MP-057	1	1	2	1	0					
Alfalfa	MP-058	0	0	2	1	1					
Alfalfa	MP-059	0	0	2	1	1					
Alfalfa	MP-060	0	0	4	1	2					
Alfalfa	MP-062	0	0	4	1	2					
Alfalfa	MP-065	0	0	1	1	0					
Alfalfa	MP-066	4	4	0	0	0					
Alfalfa	MP-067	0	0	2	1	0					
Alfalfa	MP-068	0	0	1	1	0					
Alfalfa	MP-069	0	0	2	1	1					
Alfalfa	MP-070	0	0	4	1	2					
Alfalfa	MP-071	4	4	0	0	0					
Alfalfa	MP-072	0	0	1	0	0					
Alfalfa	MP-077	0	0	1	1	0					
Alfalfa	MP-078	0	0	2	1	0					
Alfalfa	MP-079	0	0	4	1	2					
Alfalfa	MP-100	0	0	1	1	1					

Appendix 3 b -- Phytotox Scores 2001
% Values

Species	Sample	PE 21 Height	PE 21 Shoot Color	PE 21 Shoot Appearance	Count	Shoot Color	Shoot Appearance	Mean Shoot Height (mm)	Root Color	Root Appearance	Mean Root Length (mm)	Mean Nodule Number
Alfalfa	MP-024				0	1	1	1	1	1	1	4
Alfalfa	MP-033				0	0	0	0	0	0	0	1
Alfalfa	MP-034				0	1	0	1	1	1	0	1
Alfalfa	MP-035				4	1	4	4	0	4	4	4
Alfalfa	MP-036				0	1	0	1	1	2	1	4
Alfalfa	MP-042				0	1	0	1	2	2	1	4
Alfalfa	MP-051				1	2	4	4	4	4	4	4
Alfalfa	MP-053				4	4	4	4	0	4	4	4
Alfalfa	MP-056				0	2	4	2	4	4	4	4
Alfalfa	MP-057				1	2	0	1	1	2	1	4
Alfalfa	MP-058				1	2	2	2	4	4	2	4
Alfalfa	MP-059				0	2	2	2	2	4	2	4
Alfalfa	MP-060				0	2	4	4	2	4	4	4
Alfalfa	MP-062				0	2	2	2	1	4	2	4
Alfalfa	MP-065				0	1	0	1	0	1	0	4
Alfalfa	MP-066				4	4	4	4	4	4	4	4
Alfalfa	MP-067				0	1	0	1	1	1	1	4
Alfalfa	MP-068				0	1	0	1	1	1	1	4
Alfalfa	MP-069				0	1	1	1	1	2	1	4
Alfalfa	MP-070				0	4	4	4	4	4	4	4
Alfalfa	MP-071				4	4	4	4	4	4	4	4
Alfalfa	MP-072				0	1	0	1	1	1	1	4
Alfalfa	MP-077				0	1	0	1	1	1	1	4
Alfalfa	MP-078				0	2	1	1	1	2	1	4
Alfalfa	MP-079				0	1	2	2	2	4	4	4
Alfalfa	MP-100				0	1	0	1	0	1	1	0

Appendix 3 b -- Phytotox Scores 2001
% Values

Species	Sample	Shoot Dry Weight (g)	Root Dry Weight (g)	Total Dry Weight (g)	Total Dry Weight per Plant (g)	Mean Net Growth - Leaf Number	Mean Net Growth - Branching
Alfalfa	MP-024	1	2	1	2		
Alfalfa	MP-033	0	1	0	0		
Alfalfa	MP-034	1	1	1	1		
Alfalfa	MP-035	4	4	4	4		
Alfalfa	MP-036	1	2	1	1		
Alfalfa	MP-042	2	2	2	2		
Alfalfa	MP-051	4	4	4	4		
Alfalfa	MP-053	4	4	4	4		
Alfalfa	MP-056	2	4	2	2		
Alfalfa	MP-057	2	2	2	2		
Alfalfa	MP-058	2	4	2	2		
Alfalfa	MP-059	2	4	2	2		
Alfalfa	MP-060	4	4	4	4		
Alfalfa	MP-062	2	4	2	2		
Alfalfa	MP-065	1	1	1	1		
Alfalfa	MP-066	4	4	4	4		
Alfalfa	MP-067	1	1	1	1		
Alfalfa	MP-068	1	1	1	1		
Alfalfa	MP-069	2	1	1	2		
Alfalfa	MP-070	4	4	4	4		
Alfalfa	MP-071	4	4	4	4		
Alfalfa	MP-072	1	1	1	1		
Alfalfa	MP-077	1	1	1	1		
Alfalfa	MP-078	2	2	2	2		
Alfalfa	MP-079	2	4	2	2		
Alfalfa	MP-100	1	1	1	1		

Appendix 3 b -- Phytotox Scores 2001
Scores

Species	Sample	Emergence Count	PE 7 Count	PE 7 Height	PE 7 Shoot Color	PE 7 Shoot Appearance	PE 14 Count	PE 14 Height	PE 14 Shoot Color	PE 14 Shoot Appearance	PE 21 Count	PE 21 Height	PE 21 Shoot Color	PE 21 Shoot Appearance
Alder	MT-01		0	0	0	0	0	1	0	0				
Alder	MT-02		1	0	0	0	1	0	0	0				
Alder	MT-03		1	0	0	0	1	1	0	1				
Alder	MT-04		1	0	0	0	0	0	0	0				
Alder	MT-05		1	0	0	0	1	1	0	1				
Alder	MT-06		4	2	1	0	4	4	4	4				
Alder	MT-07		1	0	0	0	1	1	1	1				
Alder	MT-08		0	0	0	0	0	1	0	1				
Alder	MT-09		1	1	0	0	1	1	0	1				
Alder	MT-10		2	2	1	0	4	4	4	4				
Alder	MT-11		0	0	0	0	0	1	1	1				
Alder	MT-12		0	0	0	0	0	0	0	0				
Alder	MT-13		1	0	0	0	1	1	0	1				
Alder	MT-14		0	0	0	0	0	0	0	0				
Alder	MT-15		0	1	0	0	0	1	0	0				
Alder	MP-018													
Alder	MP-019													
Alder	MP-021													
Alder	MP-022													
Alder	MP-024													
Alder	MP-033													
Alder	MP-034													
Alder	MP-035													
Alder	MP-036													
Alder	MP-042													
Alder	MP-051													
Alder	MP-053													
Alder	MP-056													
Alder	MP-057													
Alder	MP-058													
Alder	MP-059													
Alder	MP-060													
Alder	MP-062													
Alder	MP-065													
Alder	MP-066													

Appendix 3 b -- Phytotox Scores 2001
Scores

Species	Sample	Count	Shoot Color	Shoot Appearance	Mean Shoot Height (mm)	Root Color	Root Appearance	Mean Root Length (mm)	Mean Nodule Number	Shoot Dry Weight (g)	Root Dry Weight (g)
Alder	MT-01	0	1	0	1	0	1	0		1	1
Alder	MT-02	1	1	1	0	1	1	0		1	1
Alder	MT-03	1	1	1	0	1	1	0		2	1
Alder	MT-04	1	0	1	0	1	1	0		0	1
Alder	MT-05	1	1	1	0	2	4	1		2	2
Alder	MT-06	4	4	4	4	4	4	4		4	4
Alder	MT-07	1	1	1	0	1	2	0		2	2
Alder	MT-08	0	1	2	1	1	4	0		1	1
Alder	MT-09	1	1	1	1	1	4	0		2	2
Alder	MT-10	4	4	4	4	4	4	4		4	4
Alder	MT-11	1	2	2	1	1	4	1		1	0
Alder	MT-12	0	1	1	0	1	1	0		1	2
Alder	MT-13	1	2	2	1	2	4	1		2	4
Alder	MT-14	0	1	2	0	1	1	0		1	1
Alder	MT-15	0	1	2	1	1	4	1		1	2
Alder	MP-018	0	1	0	0	0	0	0			
Alder	MP-019	0	0	0	0	0	0	0			
Alder	MP-021	0	0	0	0	0	0	0			
Alder	MP-022	0	1	0	0	0	0	0			
Alder	MP-024	0	0	0	0	0	0	0			
Alder	MP-033	0	1	0	0	0	0	0			
Alder	MP-034	0	0	0	0	0	1	0			
Alder	MP-035	1	4	0	0	0	4	0			
Alder	MP-036	0	1	0	0	0	0	0			
Alder	MP-042	0	0	0	0	0	0	0			
Alder	MP-051	0	2	0	0	0	2	0			
Alder	MP-053	0	2	0	0	0	2	0			
Alder	MP-056	0	1	0	0	0	1	0			
Alder	MP-057	0	1	0	0	0	0	0			
Alder	MP-058	0	1	0	0	0	1	0			
Alder	MP-059	0	1	0	0	0	1	0			
Alder	MP-060	0	1	0	0	0	2	0			
Alder	MP-062	0	1	0	0	0	1	0			
Alder	MP-065	0	0	0	0	0	0	0			
Alder	MP-066	4	4	0	0	0	4	0			

Appendix 3 b -- Phytotox Scores 2001
Scores

Species	Sample	Total Dry Weight (g)	Total Dry Weight per Plant (g)	Mean Net Growth - Leaf Number	Mean Net Growth - Branching	Mean Phytotoxicity Score
Alder	MT-01	1	0			0.24
Alder	MT-02	1	0			0.39
Alder	MT-03	2	1			0.68
Alder	MT-04	0	0			0.21
Alder	MT-05	2	1			1.03
Alder	MT-06	4	4			3.50
Alder	MT-07	2	2			0.84
Alder	MT-08	1	1			0.68
Alder	MT-09	2	1			0.97
Alder	MT-10	4	4			3.39
Alder	MT-11	0	0			0.74
Alder	MT-12	1	1			0.39
Alder	MT-13	2	2			1.37
Alder	MT-14	1	1			0.45
Alder	MT-15	2	1			0.87
Alder	MP-018		1	1	0	0.25
Alder	MP-019		1	4	0	0.45
Alder	MP-021		0	0	0	0.00
Alder	MP-022		1	0	0	0.10
Alder	MP-024		1	0	0	0.05
Alder	MP-033		1	0	0	0.15
Alder	MP-034		1	0	0	0.10
Alder	MP-035		4	4	0	1.65
Alder	MP-036		1	0	0	0.20
Alder	MP-042		1	0	0	0.10
Alder	MP-051		2	4	0	1.00
Alder	MP-053		2	4	0	1.00
Alder	MP-056		1	4	0	0.60
Alder	MP-057		1	4	0	0.60
Alder	MP-058		1	4	0	0.65
Alder	MP-059		1	1	0	0.40
Alder	MP-060		2	4	0	0.90
Alder	MP-062		2	4	0	0.80
Alder	MP-065		0	1	0	0.10
Alder	MP-066		4	4	0	2.00

Appendix 3 b -- Phytotox Scores 2001
Scores

Species	Sample	Emergence Count	PE 7 Count	PE 7 Height	PE 7 Shoot Color	PE 7 Shoot Appearance	PE 14 Count	PE 14 Height	PE 14 Shoot Color	PE 14 Shoot Appearance	PE 21 Count	PE 21 Height	PE 21 Shoot Color	PE 21 Shoot Appearance
Alder	MP-067													
Alder	MP-068													
Alder	MP-069													
Alder	MP-070													
Alder	MP-071													
Alder	MP-072													
Alder	MP-077													
Alder	MP-078													
Alder	MP-079													
Alder	MP-100													
Alfalfa	MT-01	1	1	0	0	0								
Alfalfa	MT-02	1	1	1	1	0								
Alfalfa	MT-03	0	0	1	0	0								
Alfalfa	MT-04	0	0	1	0	0								
Alfalfa	MT-05	0	0	2	1	0								
Alfalfa	MT-06	4	4	0	0	0								
Alfalfa	MT-07	0	0	1	1	0								
Alfalfa	MT-08	0	0	2	1	0								
Alfalfa	MT-09	0	0	1	1	0								
Alfalfa	MT-10	4	4	0	0	0								
Alfalfa	MT-11	1	1	2	1	0								
Alfalfa	MT-12	1	1	1	1	0								
Alfalfa	MT-13	0	0	1	1	0								
Alfalfa	MT-14	0	0	1	0	0								
Alfalfa	MT-15	0	1	2	1	0								

Appendix 3 b -- Phytotox Scores 2001
Scores

Species	Sample	Count	Shoot Color	Shoot Appearance	Mean Shoot Height (mm)	Root Color	Root Appearance	Mean Root Length (mm)	Mean Nodule Number	Shoot Dry Weight (g)	Root Dry Weight (g)
Alder	MP-067	0	0	0	0	0	0	0			
Alder	MP-068	0	0	0	0	0	0	0			
Alder	MP-069	0	1	0	0	0	0	0			
Alder	MP-070	0	1	0	0	0	1	0			
Alder	MP-071	4	4	0	0	0	4	0			
Alder	MP-072	0	0	0	0	0	0	0			
Alder	MP-077	0	1	0	0	0	1	0			
Alder	MP-078	0	1	0	0	0	0	0			
Alder	MP-079	0	1	0	0	0	1	0			
Alder	MP-100	0	0	0	0	0	0	0			
Alfalfa	MT-01	1	0	0	0	0	0	0	0	0	2
Alfalfa	MT-02	1	1	0	1	1	1	1	4	1	4
Alfalfa	MT-03	0	0	0	0	0	0	0	1	1	2
Alfalfa	MT-04	0	0	0	0	0	0	0	1	0	1
Alfalfa	MT-05	1	1	0	1	1	1	1	4	1	4
Alfalfa	MT-06	4	4	0	4	4	4	4	4	4	4
Alfalfa	MT-07	0	1	0	0	1	1	0	2	1	2
Alfalfa	MT-08	0	1	0	1	1	2	1	4	2	4
Alfalfa	MT-09	0	1	0	1	1	1	1	2	1	2
Alfalfa	MT-10	4	4	0	4	4	4	4	4	4	4
Alfalfa	MT-11	1	1	0	1	1	2	1	4	2	4
Alfalfa	MT-12	1	2	0	1	1	2	1	2	2	4
Alfalfa	MT-13	0	2	0	1	1	2	1	4	1	4
Alfalfa	MT-14	0	0	0	0	0	0	0	1	0	2
Alfalfa	MT-15	0	1	0	1	1	2	1	4	2	4

Appendix 3 b -- Phytotox Scores 2001
Scores

Species	Sample	Total Dry Weight (g)	Total Dry Weight per Plant (g)	Mean Net Growth - Leaf Number	Mean Net Growth - Branching	Mean Phytotoxicity Score
Alder	MP-067		1	4	0	0.50
Alder	MP-068		1	4	0	0.45
Alder	MP-069		1	1	0	0.30
Alder	MP-070		2	4	0	0.80
Alder	MP-071		4	4	0	2.00
Alder	MP-072		1	4	0	0.50
Alder	MP-077		2	4	0	0.75
Alder	MP-078		1	4	0	0.55
Alder	MP-079		2	0	0	0.40
Alder	MP-100		1	4	0	0.50
Alfalfa	MT-01	0	0			0.21
Alfalfa	MT-02	2	1			1.21
Alfalfa	MT-03	1	1			0.41
Alfalfa	MT-04	0	0			0.12
Alfalfa	MT-05	2	2			1.26
Alfalfa	MT-06	4	4			3.06
Alfalfa	MT-07	1	1			0.65
Alfalfa	MT-08	2	2			1.35
Alfalfa	MT-09	1	1			0.71
Alfalfa	MT-10	4	4			3.06
Alfalfa	MT-11	2	2			1.44
Alfalfa	MT-12	2	2			1.41
Alfalfa	MT-13	1	1			1.15
Alfalfa	MT-14	1	1			0.26
Alfalfa	MT-15	2	2			1.38

Appendix 3 b -- Phytotox Scores 2001
Scores

Species	Sample	Emergence Count	PE 7 Count	PE 7 Height	PE 7 Shoot Color	PE 7 Shoot Appearance	PE 14 Count	PE 14 Height	PE 14 Shoot Color	PE 14 Shoot Appearance	PE 21 Count	PE 21 Height	PE 21 Shoot Color	PE 21 Shoot Appearance
Alfalfa	MP-018	0	0	1	0	0								
Alfalfa	MP-019	0	0	1	1	0								
Alfalfa	MP-021	0	0	2	1	0								
Alfalfa	MP-022	0	0	1	1	0								
Alfalfa	MP-024	0	0	2	1	1								
Alfalfa	MP-033	0	0	0	0	0								
Alfalfa	MP-034	0	0	1	1	1								
Alfalfa	MP-035	0	0	4	1	4								
Alfalfa	MP-036	0	0	1	1	0								
Alfalfa	MP-042	0	0	2	1	1								
Alfalfa	MP-051	0	0	4	2	4								
Alfalfa	MP-053	0	0	4	4	4								
Alfalfa	MP-056	0	0	4	1	0								
Alfalfa	MP-057	0	0	2	1	0								
Alfalfa	MP-058	0	0	2	1	1								
Alfalfa	MP-059	0	0	2	1	1								
Alfalfa	MP-060	0	0	4	1	2								
Alfalfa	MP-062	0	0	4	1	2								
Alfalfa	MP-065	0	0	1	1	0								
Alfalfa	MP-066	0	0	0	0	0								
Alfalfa	MP-067	0	0	2	1	0								
Alfalfa	MP-068	0	0	1	1	0								
Alfalfa	MP-069	0	0	2	1	1								
Alfalfa	MP-070	0	0	4	1	2								
Alfalfa	MP-071	0	0	0	0	0								
Alfalfa	MP-072	0	0	1	0	0								
Alfalfa	MP-077	0	0	1	1	0								
Alfalfa	MP-078	0	0	2	1	0								
Alfalfa	MP-079	0	0	4	1	2								
Alfalfa	MP-100	0	0	1	1	1								
Mean Endpoint Score		0.23	0.36	1.33	0.58	0.40	0.83	0.93	0.60	0.87				

Appendix 3 b -- Phytotox Scores 2001
Scores

Species	Sample	Count	Shoot Color	Shoot Appearance	Mean Shoot Height (mm)	Root Color	Root Appearance	Mean Root Length (mm)	Mean Nodule Number	Shoot Dry Weight (g)	Root Dry Weight (g)
Alfalfa	MP-018	0	2	0	1	1	1	1	4	1	1
Alfalfa	MP-019	0	0	0	1	1	1	0	0	1	1
Alfalfa	MP-021	0	1	0	1	2	2	1	4	2	2
Alfalfa	MP-022	0	1	0	1	1	1	0	2	1	1
Alfalfa	MP-024	0	1	1	1	1	1	1	4	1	2
Alfalfa	MP-033	0	0	0	0	0	0	0	1	0	1
Alfalfa	MP-034	0	1	0	1	1	1	0	1	1	1
Alfalfa	MP-035	0	1	4	4	0	4	4	4	4	4
Alfalfa	MP-036	0	1	0	1	1	2	1	4	1	2
Alfalfa	MP-042	0	1	0	1	2	2	1	4	2	2
Alfalfa	MP-051	0	2	4	4	4	4	4	4	4	4
Alfalfa	MP-053	0	4	4	4	0	4	4	4	4	4
Alfalfa	MP-056	0	2	4	2	4	4	4	4	2	4
Alfalfa	MP-057	0	2	0	1	1	2	1	4	2	2
Alfalfa	MP-058	0	2	2	2	4	4	2	4	2	4
Alfalfa	MP-059	0	2	2	2	2	4	2	4	2	4
Alfalfa	MP-060	0	2	4	4	2	4	4	4	4	4
Alfalfa	MP-062	0	2	2	2	1	4	2	4	2	4
Alfalfa	MP-065	0	1	0	1	0	1	0	4	1	1
Alfalfa	MP-066	0	4	4	4	4	4	4	4	4	4
Alfalfa	MP-067	0	1	0	1	1	1	1	4	1	1
Alfalfa	MP-068	0	1	0	1	1	1	1	4	1	1
Alfalfa	MP-069	0	1	1	1	1	2	1	4	2	1
Alfalfa	MP-070	0	4	4	4	4	4	4	4	4	4
Alfalfa	MP-071	0	4	4	4	4	4	4	4	4	4
Alfalfa	MP-072	0	1	0	1	1	1	1	4	1	1
Alfalfa	MP-077	0	1	0	1	1	1	1	4	1	1
Alfalfa	MP-078	0	2	1	1	1	2	1	4	2	2
Alfalfa	MP-079	0	1	2	2	2	4	4	4	2	4
Alfalfa	MP-100	0	1	0	1	0	1	1	0	1	1
Mean Endpoint Score		0.38	1.27	0.72	0.87	0.91	1.73	0.91	3.20	1.72	2.42

Appendix 3 b -- Phytotox Scores 2001
Scores

Species	Sample	Total Dry Weight (g)	Total Dry Weight per Plant (g)	Mean Net Growth - Leaf Number	Mean Net Growth - Branching	Mean Phytotoxicity Score
Alfalfa	MP-018	1	1			0.82
Alfalfa	MP-019	1	1			0.44
Alfalfa	MP-021	2	2			1.29
Alfalfa	MP-022	1	1			0.59
Alfalfa	MP-024	1	2			1.09
Alfalfa	MP-033	0	0			0.09
Alfalfa	MP-034	1	1			0.59
Alfalfa	MP-035	4	4			2.71
Alfalfa	MP-036	1	1			0.94
Alfalfa	MP-042	2	2			1.29
Alfalfa	MP-051	4	4			3.06
Alfalfa	MP-053	4	4			3.06
Alfalfa	MP-056	2	2			2.29
Alfalfa	MP-057	2	2			1.29
Alfalfa	MP-058	2	2			1.97
Alfalfa	MP-059	2	2			1.85
Alfalfa	MP-060	4	4			2.76
Alfalfa	MP-062	2	2			2.00
Alfalfa	MP-065	1	1			0.62
Alfalfa	MP-066	4	4			2.59
Alfalfa	MP-067	1	1			0.88
Alfalfa	MP-068	1	1			0.79
Alfalfa	MP-069	1	2			1.18
Alfalfa	MP-070	4	4			3.00
Alfalfa	MP-071	4	4			2.59
Alfalfa	MP-072	1	1			0.68
Alfalfa	MP-077	1	1			0.79
Alfalfa	MP-078	2	2			1.35
Alfalfa	MP-079	2	2			2.12
Alfalfa	MP-100	1	1			0.53
Mean Endpoint Score		1.78	1.60	2.53	0.00	1.07

Appendix 3 b -- Phytotox Scores 2001
Statistical Summary

Species	Emergence Count	PE 7 Count	PE 7 Height	PE 7 Shoot Color	PE 7 Shoot Appearance	PE 14 Count	PE 14 Height	PE 14 Shoot Color	PE 14 Shoot Appearance
alder-2000		0.0004	0.0000	0.0147	0.4543	0.0002	0.0017	0.0075	0.0061
alder-2001									
alfalfa-2000	0.0000	0.0000	0.0002	0.0004	0.5394				
alfalfa-2001	0.6362	0.7169	0.0000	0.0002	0.0143				

	PE 21 Count	PE 21 Height	PE 21 Shoot Color	PE 21 Shoot Appearance	Count	Shoot Color	Shoot Appearance	Mean Shoot Height (mm)	Root Color
alder-2000					0.0248	0.0080	0.0008	0.0389	0.0098
alder-2001						0.0216	0.1206	0.1755	0.5518
alfalfa-2000					0.0057	0.0000	0.0856	0.0000	0.0001
alfalfa-2001					0.4938	0.0000	0.0116	0.0000	0.0000

	Root Appearance	Mean Root Length (mm)	Mean Nodule Number	Shoot Dry Weight (g)	Root Dry Weight (g)	Total Dry Weight (g)	Total Dry Weight per Plant (g)	Mean Net Growth - Leaf Number	Mean Net Growth - Branching
alder-2000	0.0000	0.0017		0.0030	0.0166	0.0077	0.0121		
alder-2001		0.8294		0.2610	0.0071	0.0073			0.2110
alfalfa-2000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000		
alfalfa-2001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0009		

Appendix 3 b -- Phytotox Scores 2001
Summary

Sample ID	Alder	Alfalfa	Dogwood	Sedge	Means	Toxicity Categories
MT-01	0.24	0.21	0.11	1.24	0.45	Mildly Phytotoxic
MT-02	0.39	1.21	0.63	1.37	0.90	Moderately Phytotoxic
MT-03	0.68	0.41	0.30	0.29	0.42	Mildly Phytotoxic
MT-04	0.21	0.12	0.22	0.16	0.18	Non-phytotoxic
MT-05	1.03	1.26	1.54	1.47	1.33	Highly Phytotoxic
MT-06	3.50	3.06	4.00	3.56	3.53	Severely Phytotoxic
MT-07	0.84	0.65	0.37	1.11	0.74	Moderately Phytotoxic
MT-08	0.68	1.35	0.96	1.26	1.06	Highly Phytotoxic
MT-09	0.97	0.71	0.87	0.84	0.85	Moderately Phytotoxic
MT-10	3.39	3.06	3.54	2.83	3.21	Severely Phytotoxic
MT-11	0.74	1.44	0.57	1.63	1.09	Highly Phytotoxic
MT-12	0.39	1.41	0.30	1.16	0.82	Moderately Phytotoxic
MT-13	1.37	1.15	0.54	1.63	1.17	Highly Phytotoxic
MT-14	0.45	0.26	0.13	1.24	0.52	Moderately Phytotoxic
MT-15	0.87	1.38	1.37	1.16	1.19	Highly Phytotoxic
MP-018	0.25	0.82			0.54	Moderately Phytotoxic
MP-019	0.45	0.44			0.45	Mildly Phytotoxic
MP-021	0.00	1.29			0.65	Moderately Phytotoxic
MP-022	0.10	0.59			0.34	Mildly Phytotoxic
MP-024	0.05	1.09			0.57	Moderately Phytotoxic
MP-033	0.15	0.09			0.12	Non-phytotoxic
MP-034	0.10	0.59			0.34	Mildly Phytotoxic
MP-035	1.65	2.71			2.18	Severely Phytotoxic
MP-036	0.20	0.94			0.57	Moderately Phytotoxic
MP-042	0.10	1.29			0.70	Moderately Phytotoxic
MP-051	1.00	3.06			2.03	Severely Phytotoxic
MP-053	1.00	3.06			2.03	Severely Phytotoxic
MP-056	0.60	2.29			1.45	Highly Phytotoxic
MP-057	0.60	1.29			0.95	Moderately Phytotoxic
MP-058	0.65	1.97			1.31	Highly Phytotoxic
MP-059	0.40	1.85			1.13	Highly Phytotoxic
MP-060	0.90	2.76			1.83	Highly Phytotoxic
MP-062	0.80	2.00			1.40	Highly Phytotoxic
MP-065	0.10	0.62			0.36	Mildly Phytotoxic
MP-066	2.00	2.59			2.29	Severely Phytotoxic
MP-067	0.50	0.88			0.69	Moderately Phytotoxic
MP-068	0.45	0.79			0.62	Moderately Phytotoxic
MP-069	0.30	1.18			0.74	Moderately Phytotoxic
MP-070	0.80	3.00			1.90	Highly Phytotoxic
MP-071	2.00	2.59			2.29	Severely Phytotoxic
MP-072	0.50	0.68			0.59	Moderately Phytotoxic
MP-077	0.75	0.79			0.77	Moderately Phytotoxic
MP-078	0.55	1.35			0.95	Moderately Phytotoxic
MP-079	0.40	2.12			1.26	Highly Phytotoxic
MP-100	0.50	0.53			0.51	Moderately Phytotoxic
Means	0.75	1.40	1.03	1.40	1.09	

Toxicity Categories	Moderately Phytotoxic	Highly Phytotoxic	Highly Phytotoxic	Highly Phytotoxic

Alder

Count of Harvest Condition	Harvest Condit	
Irrigation T	Treatment	Alive	Dead
Subsurface	05cm	1	2
	15cm	3	
	25cm	3	
Surface	05cm	3	
	15cm	3	
	25cm	3	

Mean Net Branch Length (mm)		
Irrigation T	Treatment	Total
Subsurface	05cm	-1.3
	15cm	64.7
	25cm	117.7
Surface	05cm	5.7
	15cm	78.7
	25cm	56.3

Mean Net Root Length (mm)		
Irrigation T	Treatment	Total
Subsurface	05cm	-9.3
	15cm	-0.3
	25cm	76.7
Surface	05cm	-24.3
	15cm	29.7
	25cm	113.0

Mean Total Dry Weight (g)		
Irrigation T	Treatment	Total
Subsurface	05cm	0.936
	15cm	4.274
	25cm	6.157
Surface	05cm	3.871
	15cm	5.557
	25cm	11.402

Mean Net Leaf Number		
Irrigation T	Treatment	Total
Subsurface	05cm	-7.7
	15cm	12.7
	25cm	36.7
Surface	05cm	6.0
	15cm	23.3
	25cm	22.3

Mean Net Number of Branches at Harvest		
Irrigation Type	Treatment	Total
Subsurface	05cm	0.3
	15cm	-0.7
	25cm	0.0
Surface	05cm	0.3
	15cm	0.3
	25cm	0.7

Alfalfa

Mean Harvest Count		
Irrigation T	Treatment	Total
Subsurface	05cm	5.7
	15cm	7.0
	25cm	8.3
Surface	05cm	5.3
	15cm	6.7
	25cm	6.0

Mean Shoot Height (mm)		
Irrigation T	Treatment	Total
Subsurface	05cm	45.2
	15cm	71.7
	25cm	88.6
Surface	05cm	64.2
	15cm	90.5
	25cm	75.3

Mean Root Length (mm)		
Irrigation T	Treatment	Total
Subsurface	05cm	75.7
	15cm	174.3
	25cm	229.4
Surface	05cm	82.8
	15cm	152.0
	25cm	198.0

Mean Total Dry Weight (g)		
Irrigation T	Treatment	Total
Subsurface	05cm	0.212
	15cm	0.319
	25cm	0.356
Surface	05cm	0.135
	15cm	0.387
	25cm	0.198

Mean Total Dry Weight (g) per Plan		
Irrigation T	Treatment	Total
Subsurface	05cm	0.038
	15cm	0.046
	25cm	0.043
Surface	05cm	0.026
	15cm	0.061
	25cm	0.032

Mean Number of Nodules		
Irrigation Type	Treatment	Total
Subsurface	05cm	0.1
	15cm	0.2
	25cm	0.5
Surface	05cm	1.3
	15cm	2.4
	25cm	1.5

Sedge

Count of Harvest Condition	Harvest Condit	
Irrigation T	Treatment	Alive
Subsurface	05cm	3
	15cm	3
	25cm	3
Surface	05cm	3
	15cm	3
	25cm	3

Mean Net Branch Length (mm)		
Irrigation T	Treatment	Total
Subsurface	05cm	51.7
	15cm	250.3
	25cm	278.0
Surface	05cm	31.3
	15cm	14.3
	25cm	28.0

Mean Net Root Length (mm)		
Irrigation T	Treatment	Total
Subsurface	05cm	-22.3
	15cm	37.0
	25cm	81.7
Surface	05cm	-36.3
	15cm	28.7
	25cm	145.7

Mean Total Dry Weight (g)		
Irrigation T	Treatment	Total
Subsurface	05cm	0.814
	15cm	2.042
	25cm	2.721
Surface	05cm	1.003
	15cm	2.269
	25cm	1.677

Wheat

Mean Harvest Count		
Irrigation T	Treatment	Total
Subsurface	05cm	7.3
	15cm	8.3
	25cm	7.3
Surface	05cm	7.0
	15cm	8.0
	25cm	8.3

Mean Shoot Height (mm)		
Irrigation T	Treatment	Total
Subsurface	05cm	236.1
	15cm	415.5
	25cm	449.6
Surface	05cm	331.1
	15cm	317.3
	25cm	306.4

Meant Root Length (mm)		
Irrigation T	Treatment	Total
Subsurface	05cm	87.7
	15cm	215.7
	25cm	292.0
Surface	05cm	120.3
	15cm	248.3
	25cm	278.3

Mean Total Dry Weight (g)		
Irrigation T	Treatment	Total
Subsurface	05cm	1.051
	15cm	3.734
	25cm	5.139
Surface	05cm	0.822
	15cm	1.148
	25cm	1.227

Mean Total Dry Weight (g) per Plant		
Irrigation T	Treatment	Total
Subsurface	05cm	0.145
	15cm	0.449
	25cm	0.706
Surface	05cm	0.120
	15cm	0.145
	25cm	0.147

Willow

Count of Harvest Condition	Harvest Condit	
Irrigation T	Treatment	Alive
Subsurface	05cm	3
	15cm	3
	25cm	3
Surface	05cm	3
	15cm	3
	25cm	3

Mean Net Branch Length (mm)		
Irrigation T	Treatment	Total
Subsurface	05cm	135.3
	15cm	137.3
	25cm	199.7
Surface	05cm	6.0
	15cm	34.7
	25cm	28.3

Mean Net Root Length (mm)		
Irrigation T	Treatment	Total
Subsurface	05cm	-8.7
	15cm	53.3
	25cm	104.0
Surface	05cm	-2.7
	15cm	27.3
	25cm	184.7

Mean Total Dry Weight (g)		
Irrigation T	Treatment	Total
Subsurface	05cm	9.596
	15cm	14.053
	25cm	13.614
Surface	05cm	7.890
	15cm	7.594
	25cm	9.404

Mean Net Leaf Number		
Irrigation T	Treatment	Total
Subsurface	05cm	20.3
	15cm	65.7
	25cm	63.7
Surface	05cm	4.0
	15cm	11.0
	25cm	5.3

Mean Net Number of Branches at Harvest		
Irrigation Type	Treatment	Total
Subsurface	05cm	-0.7
	15cm	3.0
	25cm	2.3
Surface	05cm	-0.3
	15cm	0.0
	25cm	1.0

	surface			subsurface		
	5-cm	15-cm	25-cm	5-cm	15-cm	25-cm
Alder						
shoot height	5.7	78.7	56.3	-1.3	64.7	117.7
root length	-24.3	29.7	113.0	-9.3	-0.3	76.7
dry weight (g) per plant	3.871	5.557	11.402	0.936	4.274	6.157
Alfalfa						
shoot height	64.2	90.5	75.3	45.2	71.7	88.6
root length	82.8	152.0	198.0	75.7	174.3	229.4
dry weight (g) per plant	0.026	0.061	0.032	0.038	0.046	0.043
nodule number	1.3	2.4	1.5	0.1	0.2	0.5
sedge						
shoot height	31.3	14.3	28.0	51.7	250.3	278.0
root length	-36.3	28.7	145.7	-22.3	37.0	81.7
dry weight (g) per plant	1.003	2.269	1.677	0.814	2.042	2.721
wheat						
shoot height	331.1	317.3	306.4	236.1	415.5	449.6
root length	120.3	248.3	278.3	87.7	215.7	292.0
dry weight (g) per plant	0.120	0.145	0.147	0.145	0.449	0.706
willow						
shoot height	6.0	34.7	28.3	135.3	137.3	199.7
root length	-2.7	27.3	184.7	-8.7	53.3	104.0
dry weight (g) per plant	7.890	7.594	9.404	9.596	14.053	13.614

Alfalfa (2001) seedlings at harvest. Treatment numbers correspond to sample sites as follows:

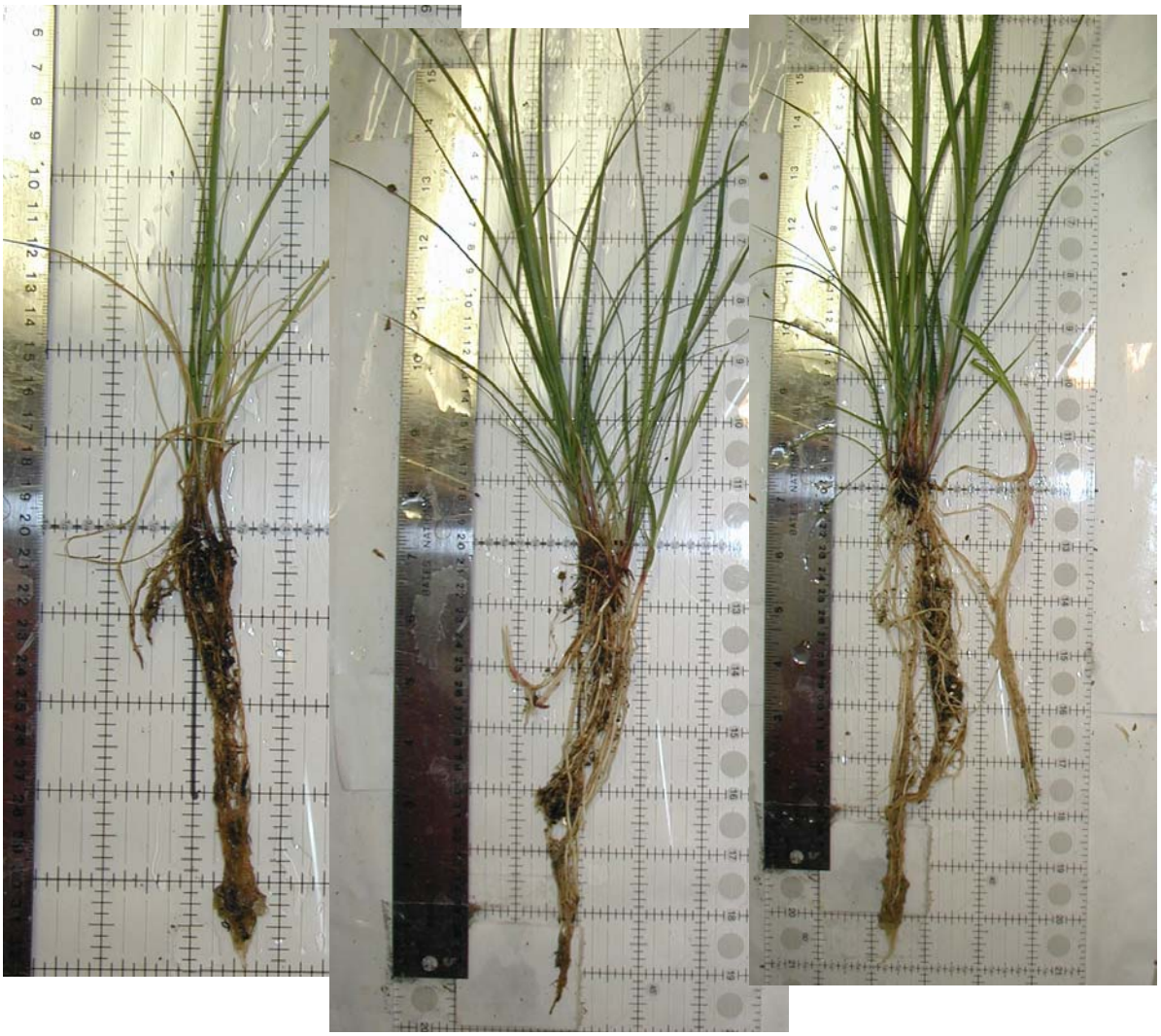
Treatment 19 ..... MP-065	Treatment 22..... MP-068
Treatment 20 ..... MP-066	Treatment 23..... MP-069
Treatment 21 ..... MP-067	Treatment 24..... MP-070

Set up of tubes with alfalfa, alder, dogwood, sedge, or willow with sub-surface or surface irrigation; tailings overlain with 5-, 15, or 25 cm Camas soil.

Alder roots in Camas soil. Note roots failed to penetrate the tailings (lighter brown soil at bottom).

Harvested alder seedling (1-year old at planting) from a surface irrigated treatment of 5-cm Camas soil overlaying tailings. Note the proliferation of root mass in the upper portion of the roots, which correspond to the zone of Camas soil. (When removed from the tube, the root mass drooped somewhat from the weight of the adhering particles.) In contrast, the root mass that was planted from the conetainers, that was placed into the tailings, failed to develop any additional roots.

Alder seedlings from the 5-cm, 15-cm, and 25-cm treatments of Camas soil overlaying slickens.



Sedge from the 5-cm, 15-cm, and 25-cm Camas soil treatments (left to right). Photos are not of equal scale (Note the gridlines in the background). Also, note that in the 25-cm treatment, the roots were folded up to allow the root mass to be in the same frame.

Plot ID	CLIP PLOT	PERIOD	LIFE FORM	WEIGHT
MP-100	A	1	FORB	10.79
MP-100	A	1	GRAMINOID	2.71
MP-100	B	1	FORB	11.12
MP-100	B	1	GRAMINOID	2.98
MP-018	A	1	GRAMINOID	35.06
MP-018	C	1	FORB	0.32
MP-018	C	1	GRAMINOID	49.17
MP-019	B	1	FORB	1.07
MP-019	B	1	GRAMINOID	5.55
MP-019	D	1	FORB	2.90
MP-019	D	1	GRAMINOID	13.14
MP-021	A	1	FORB	8.09
MP-021	A	1	GRAMINOID	0.92
MP-021	B	1	GRAMINOID	0.25
MP-022	C	1	FORB	5.02
MP-022	C	1	GRAMINOID	2.98
MP-022	D	1	FORB	3.06
MP-022	D	1	GRAMINOID	18.73
MP-024	A	1	FORB	4.76
MP-024	A	1	GRAMINOID	41.97
MP-024	D	1	FORB	0.82
MP-024	D	1	GRAMINOID	9.13
MP-033	A	1	FORB	0.45
MP-033	A	1	GRAMINOID	48.30
MP-033	B	1	FORB	4.49
MP-033	B	1	GRAMINOID	53.68
MP-034	A	1	FORB	8.11
MP-034	A	1	GRAMINOID	0.03
MP-034	D	1	FORB	10.89
MP-034	D	1	GRAMINOID	17.79
MP-035	B	1	GRAMINOID	13.15
MP-036	C	1	GRAMINOID	22.47
MP-036	D	1	FORB	3.05
MP-036	D	1	GRAMINOID	12.92
MP-042	A	1	FORB	0.01
MP-042	D	1	FORB	0.01
MP-042	D	1	GRAMINOID	11.13
MP-051	B	1	GRAMINOID	5.40
MP-051	C	1	FORB	3.74
MP-051	C	1	GRAMINOID	10.67
MP-053	D	1	FORB	0.02
MP-053	D	1	GRAMINOID	0.10
MP-053	A	1	GRAMINOID	0.01
MP-056	B	1	GRAMINOID	16.24
MP-058	A	1	FORB	0.73
MP-058	A	1	GRAMINOID	11.21
MP-058	B	1	FORB	0.60
MP-058	B	1	GRAMINOID	9.37
MP-059	B	1	FORB	0.43
MP-059	B	1	GRAMINOID	7.42
MP-059	C	1	FORB	1.40
MP-059	C	1	GRAMINOID	3.40
MP-060	A	1	FORB	0.01
MP-060	A	1	GRAMINOID	5.32
MP-060	D	1	FORB	0.15
MP-060	D	1	GRAMINOID	5.14
MP-062	B	1	FORB	0.06
MP-062	B	1	GRAMINOID	10.92
MP-062	D	1	FORB	2.00
MP-062	D	1	GRAMINOID	10.37
MP-065	B	1	FORB	0.04
MP-065	B	1	GRAMINOID	67.45

MP-065	D	1	GRAMINOID	61.27
MP-066	C	1	GRAMINOID	0.04
MP-067	A	1	FORB	0.99
MP-067	A	1	GRAMINOID	0.04
MP-067	D	1	GRAMINOID	0.08
MP-068	A	1	FORB	1.23
MP-068	A	1	GRAMINOID	12.95
MP-068	D	1	FORB	0.13
MP-068	D	1	GRAMINOID	15.08
MP-069	A	1	FORB	0.32
MP-069	A	1	GRAMINOID	18.11
MP-069	D	1	FORB	0.84
MP-069	D	1	GRAMINOID	20.72
MP-070	A	1	GRAMINOID	23.95
MP-070	D	1	FORB	1.00
MP-070	D	1	GRAMINOID	7.21
MP-072	A	1	FORB	2.23
MP-072	A	1	GRAMINOID	10.03
MP-072	B	1	FORB	3.16
MP-072	B	1	GRAMINOID	7.75
MP-077	B	1	FORB	2.76
MP-077	B	1	GRAMINOID	16.80
MP-077	D	1	FORB	0.01
MP-077	D	1	GRAMINOID	18.97
MP-078	B	1	FORB	1.24
MP-078	B	1	GRAMINOID	3.97
MP-078	D	1	FORB	4.00
MP-078	D	1	GRAMINOID	1.87
MP-079	B	1	FORB	1.07
MP-079	B	1	GRAMINOID	9.91
MP-079	C	1	FORB	4.40
MP-079	C	1	GRAMINOID	28.70
MP-042	A	2	FORB	2.91
MP-042	A	2	GRAMINOID	9.79
MP-042	B	2	FORB	0.70
MP-042	B	2	GRAMINOID	25.60
MP-042	C	2	FORB	0.03
MP-042	C	2	GRAMINOID	70.21
MP-042	D	2	FORB	0.04
MP-042	D	2	GRAMINOID	45.38
MP-058	A	2	FORB	0.35
MP-058	A	2	GRAMINOID	16.58
MP-058	B	2	FORB	0.47
MP-058	B	2	GRAMINOID	4.69
MP-058	C	2	FORB	0.17
MP-058	C	2	GRAMINOID	1.02
MP-058	D	2	FORB	4.98
MP-058	D	2	GRAMINOID	0.43
MP-059	A	2	FORB	0.52
MP-059	A	2	GRAMINOID	5.43
MP-059	B	2	FORB	12.20
MP-059	C	2	GRAMINOID	11.17
MP-059	D	2	FORB	42.50
MP-059	D	2	GRAMINOID	13.11
MP-059	B	2	GRAMINOID	5.87
MP-059	C	2	FORB	17.25
MP-060	A	2	GRAMINOID	11.27
MP-060	B	2	FORB	2.87
MP-060	B	2	GRAMINOID	13.00
MP-060	C	2	FORB	33.68
MP-060	C	2	GRAMINOID	14.46
MP-060	D	2	FORB	0.31
MP-060	D	2	GRAMINOID	11.74

MP-100	A	2	FORB	23.71
MP-100	A	2	GRAMINOID	1.87
MP-100	B	2	FORB	38.02
MP-100	B	2	GRAMINOID	2.00
MP-100	C	2	FORB	19.12
MP-100	C	2	GRAMINOID	16.25
MP-100	D	2	FORB	18.40
MP-100	D	2	GRAMINOID	35.29
MP-018	A	2	FORB	0.70
MP-018	A	2	GRAMINOID	72.39
MP-018	B	2	FORB	0.34
MP-018	B	2	GRAMINOID	57.44
MP-018	C	2	GRAMINOID	79.16
MP-018	C	2	FORB	0.22
MP-018	D	2	FORB	0.44
MP-018	D	2	GRAMINOID	81.53
MP-019	A	2	FORB	13.01
MP-019	A	2	GRAMINOID	56.95
MP-019	B	2	FORB	7.40
MP-019	B	2	GRAMINOID	10.42
MP-019	C	2	FORB	5.60
MP-019	C	2	GRAMINOID	32.82
MP-019	D	2	FORB	3.37
MP-019	D	2	GRAMINOID	9.47
MP-021	A	2	FORB	7.89
MP-021	A	2	GRAMINOID	1.52
MP-021	B	2	FORB	3.60
MP-021	B	2	GRAMINOID	2.14
MP-021	C	2	FORB	11.08
MP-021	C	2	GRAMINOID	14.61
MP-021	D	2	FORB	17.13
MP-021	D	2	GRAMINOID	15.97
MP-022	A	2	FORB	47.12
MP-022	A	2	GRAMINOID	27.96
MP-022	B	2	FORB	54.37
MP-022	B	2	GRAMINOID	12.96
MP-022	C	2	FORB	16.14
MP-022	C	2	GRAMINOID	7.45
MP-022	D	2	FORB	8.66
MP-022	D	2	GRAMINOID	17.01
MP-024	A	2	FORB	29.23
MP-024	A	2	GRAMINOID	24.48
MP-024	B	2	FORB	0.25
MP-024	B	2	GRAMINOID	83.77
MP-024	C	2	FORB	0.90
MP-024	C	2	GRAMINOID	33.59
MP-024	D	2	FORB	1.59
MP-024	D	2	GRAMINOID	10.42
MP-033	A	2	FORB	0.60
MP-033	A	2	GRAMINOID	76.39
MP-033	B	2	FORB	3.12
MP-033	B	2	GRAMINOID	103.72
MP-033	C	2	FORB	0.98
MP-033	C	2	GRAMINOID	162.98
MP-033	D	2	FORB	3.12
MP-033	D	2	GRAMINOID	193.70
MP-034	A	2	FORB	15.59
MP-034	A	2	GRAMINOID	0.17
MP-034	B	2	FORB	6.96
MP-034	B	2	GRAMINOID	3.66
MP-034	C	2	FORB	15.21
MP-034	C	2	GRAMINOID	15.25
MP-034	D	2	FORB	7.97

MP-034	D	2	GRAMINOID	7.39
MP-035	A	2	GRAMINOID	3.54
MP-035	B	2	GRAMINOID	17.57
MP-035	C	2	FORB	1.00
MP-035	C	2	GRAMINOID	34.96
MP-035	D	2	GRAMINOID	0.57
MP-036	A	2	FORB	16.46
MP-036	A	2	GRAMINOID	14.17
MP-036	B	2	FORB	5.20
MP-036	B	2	GRAMINOID	52.05
MP-036	C	2	FORB	3.89
MP-036	C	2	GRAMINOID	23.84
MP-036	D	2	FORB	2.98
MP-036	D	2	GRAMINOID	8.84
MP-051	A	2	GRAMINOID	18.81
MP-051	B	2	GRAMINOID	4.51
MP-051	C	2	FORB	1.33
MP-051	C	2	GRAMINOID	7.02
MP-051	D	2	FORB	13.88
MP-051	D	2	GRAMINOID	27.59
MP-053	A	2	FORB	2.65
MP-053	A	2	GRAMINOID	1.17
MP-053	B	2	FORB	0.07
MP-053	B	2	GRAMINOID	30.53
MP-053	C	2	GRAMINOID	1.75
MP-053	D	2	FORB	0.05
MP-053	D	2	GRAMINOID	0.69
MP-056	B	2	FORB	0.19
MP-056	B	2	GRAMINOID	8.42
MP-056	D	2	GRAMINOID	41.23
MP-057	A	2	FORB	19.15
MP-057	A	2	GRAMINOID	29.94
MP-057	B	2	FORB	18.67
MP-057	B	2	GRAMINOID	5.88
MP-057	C	2	FORB	35.75
MP-057	C	2	GRAMINOID	6.08
MP-057	D	2	FORB	28.94
MP-057	D	2	GRAMINOID	16.13
MP-062	A	2	FORB	30.46
MP-062	A	2	GRAMINOID	32.28
MP-062	B	2	GRAMINOID	20.90
MP-062	C	2	FORB	0.29
MP-062	C	2	GRAMINOID	23.81
MP-062	D	2	FORB	3.61
MP-062	D	2	GRAMINOID	8.32
MP-065	A	2	GRAMINOID	289.09
MP-065	B	2	GRAMINOID	213.64
MP-065	C	2	GRAMINOID	142.39
MP-065	D	2	GRAMINOID	60.86
MP-065	D	2	GRAMINOID	56.69
MP-066	A	2	GRAMINOID	28.74
MP-066	B	2	GRAMINOID	0.86
MP-066	C	2	GRAMINOID	0.55
MP-066	D	2	GRAMINOID	16.45
MP-067	A	2	FORB	3.86
MP-067	A	2	GRAMINOID	0.54
MP-067	B	2	FORB	28.09
MP-067	B	2	GRAMINOID	9.93
MP-067	C	2	FORB	0.69
MP-067	C	2	GRAMINOID	11.82
MP-067	D	2	FORB	2.86
MP-067	D	2	GRAMINOID	0.47
MP-068	A	2	FORB	5.97

MP-068	A	2	GRAMINOID	10.75
MP-068	B	2	FORB	2.20
MP-068	B	2	GRAMINOID	21.91
MP-068	C	2	FORB	1.79
MP-068	C	2	GRAMINOID	30.86
MP-068	D	2	FORB	2.55
MP-068	D	2	GRAMINOID	15.03
MP-069	A	2	FORB	2.58
MP-069	A	2	GRAMINOID	6.24
MP-069	B	2	FORB	2.43
MP-069	B	2	GRAMINOID	23.42
MP-069	C	2	FORB	15.93
MP-069	C	2	GRAMINOID	16.63
MP-069	D	2	FORB	3.97
MP-069	D	2	GRAMINOID	9.94
MP-070	A	2	GRAMINOID	15.80
MP-070	B	2	FORB	0.22
MP-070	B	2	GRAMINOID	17.90
MP-070	C	2	FORB	0.38
MP-070	D	2	FORB	2.45
MP-070	D	2	GRAMINOID	2.20
MP-072	A	2	FORB	16.49
MP-072	A	2	GRAMINOID	10.83
MP-072	B	2	FORB	33.53
MP-072	B	2	GRAMINOID	16.44
MP-072	C	2	FORB	12.02
MP-072	C	2	GRAMINOID	25.34
MP-072	D	2	FORB	23.20
MP-072	D	2	GRAMINOID	26.42
MP-077	A	2	FORB	8.80
MP-077	A	2	GRAMINOID	22.44
MP-077	B	2	FORB	5.56
MP-077	B	2	GRAMINOID	21.98
MP-077	C	2	FORB	14.24
MP-077	C	2	GRAMINOID	29.45
MP-077	D	2	FORB	0.35
MP-077	D	2	GRAMINOID	13.58
MP-078	A	2	FORB	2.98
MP-078	A	2	GRAMINOID	8.82
MP-078	B	2	FORB	2.94
MP-078	B	2	GRAMINOID	7.06
MP-078	C	2	FORB	6.73
MP-078	C	2	GRAMINOID	17.09
MP-078	D	2	FORB	6.89
MP-078	D	2	GRAMINOID	2.91
MP-079	A	2	FORB	13.69
MP-079	A	2	GRAMINOID	35.54
MP-079	B	2	FORB	14.98
MP-079	B	2	GRAMINOID	13.78
MP-079	C	2	FORB	12.64
MP-079	C	2	GRAMINOID	10.21
MP-079	D	2	FORB	3.49
MP-079	D	2	GRAMINOID	23.22
MP-018	A	1	FORB	0.00
MP-021	B	1	FORB	0.00
MP-035	A	1	FORB	0.00
MP-035	B	2	FORB	0.00
MP-035	D	2	FORB	0.00
MP-035	A	2	FORB	0.00
MP-035	A	1	GRAMINOID	0.00
MP-036	C	1	FORB	0.00
MP-042	A	1	GRAMINOID	0.00
MP-051	A	2	FORB	0.00

MP-051	B	2	FORB	0.00
MP-051	B	1	FORB	0.00
MP-053	C	2	FORB	0.00
MP-053	A	1	FORB	0.00
MP-056	A	1	FORB	0.00
MP-056	A	1	GRAMINOID	0.00
MP-056	A	2	FORB	0.00
MP-056	C	2	FORB	0.00
MP-056	D	2	FORB	0.00
MP-056	A	2	GRAMINOID	0.00
MP-056	C	2	GRAMINOID	0.00
MP-057	A	1	GRAMINOID	
MP-057	B	1	GRAMINOID	
MP-057	C	1	GRAMINOID	
MP-057	D	1	GRAMINOID	
MP-057	A	1	FORB	
MP-057	B	1	FORB	
MP-057	C	1	FORB	
MP-057	D	1	FORB	
MP-065	A	2	FORB	0.00
MP-065	C	2	FORB	0.00
MP-065	D	2	FORB	0.00
MP-065	D	1	FORB	0.00
MP-066	A	2	FORB	0.00
MP-066	B	2	FORB	0.00
MP-066	C	2	FORB	0.00
MP-066	D	2	FORB	0.00
MP-066	A	1	GRAMINOID	0.00
MP-066	A	1	FORB	0.00
MP-066	C	1	FORB	0.00
MP-070	A	1	FORB	0.00
MP-070	A	2	FORB	0.00
MP-070	C	2	GRAMINOID	0.00
MP-071	A	1	GRAMINOID	0.00
MP-071	B	1	GRAMINOID	0.00
MP-071	A	1	FORB	0.00
MP-071	B	1	FORB	0.00
MP-071	A	2	GRAMINOID	0.00
MP-071	B	2	GRAMINOID	0.00
MP-071	C	2	GRAMINOID	0.00
MP-071	D	2	GRAMINOID	0.00
MP-071	A	2	FORB	0.00
MP-071	B	2	FORB	0.00
MP-071	C	2	FORB	0.00
MP-071	D	2	FORB	0.00
MP-035	B	1	FORB	0.00
MP-056	B	1	FORB	0.00
MP-060	A	2	FORB	0.00
MP-062	B	2	FORB	0.00
MP-065	B	2	FORB	0.00
MP-067	D	1	FORB	0.00

Min	0.00
Max	289.09
Mean	14.25
Median	5.40

QA Tally of Forb Data Points by Plots, subplots, and Harvest Period.

Count of WEIGHT			PERIOD	
Plot ID	LIFE FORM	CLIP PLOT	1	2
MP-018	FORB	A	1	1
		B		1
		C	1	1
		D		
MP-019	FORB	A		1
		B	1	1
		C		1
		D	1	1
MP-021	FORB	A	1	1
		B	1	1
		C	1	
		D		
MP-022	FORB	A		1
		B	1	
		C	1	1
		D	1	1
MP-024	FORB	A	1	1
		B	1	
		C	1	
		D	1	1
MP-033	FORB	A	1	1
		B	1	1
		C	1	
		D	1	
MP-034	FORB	A	1	1
		B	1	
		C	1	
		D	1	1
MP-035	FORB	A	1	1
		B	1	1
		C	1	
		D	1	
MP-036	FORB	A	1	
		B	1	
		C	1	1
		D	1	1
MP-042	FORB	A	1	1
		B	1	
		C	1	
		D	1	1
MP-051	FORB	A		1
		B	1	1
		C	1	1
		D	1	
MP-053	FORB	A	1	1
		B	1	
		C	1	
		D	1	1
MP-056	FORB	A	1	1
		B	1	1
		C	1	
		D	1	
MP-057	FORB	A	1	
		B	1	
		C	1	
		D	1	
MP-058	FORB	A	1	1
		B	1	1
		C	1	
		D	1	
MP-059	FORB	A	1	
		B	1	1
		C	1	1
		D	1	
MP-060	FORB	A	1	1
		B	1	
		C	1	
		D	1	1
MP-062	FORB	A		1
		B	1	1
		C	1	
		D	1	1
MP-065	FORB	A		1
		B	1	1
		C	1	
		D	1	2
MP-066	FORB	A	1	1
		B	1	
		C	1	1
		D	1	
MP-067	FORB	A	1	1
		B	1	
		C	1	
		D	1	1
MP-068	FORB	A	1	1
		B	1	
		C	1	
		D	1	1
MP-069	FORB	A	1	1
		B	1	
		C	1	
		D	1	1
MP-070	FORB	A	1	1
		B	1	
		C	1	
		D	1	1
MP-071	FORB	A	1	1
		B	1	1
		C	1	
		D	1	
MP-072	FORB	A	1	1
		B	1	1
		C	1	
		D	1	
MP-077	FORB	A		1
		B	1	1
		C	1	
		D	1	1
MP-078	FORB	A		1
		B	1	1
		C	1	
		D	1	1
MP-079	FORB	A		1
		B	1	1
		C	1	1
		D		1
MP-100	FORB	A	1	1
		B	1	1
		C	1	
		D		1

QA Tally of Graminoid Data Points by Plots, subplots, and Harvest Period.

Count of WEIGHT			PERIOD	
Plot ID	LIFE FORM	CLIP PLOT	1	2
MP-018	GRAMINOID	A	1	1
		B		1
		C	1	1
		D		1
MP-019	GRAMINOID	A		1
		B	1	1
		C		1
		D	1	1
MP-021	GRAMINOID	A	1	1
		B	1	1
		C	1	
		D		1
MP-022	GRAMINOID	A		1
		B	1	
		C	1	1
		D	1	1
MP-024	GRAMINOID	A		1
		B	1	
		C	1	
		D	1	1
MP-033	GRAMINOID	A	1	1
		B	1	1
		C	1	
		D	1	
MP-034	GRAMINOID	A	1	1
		B	1	
		C	1	
		D	1	1
MP-035	GRAMINOID	A		1
		B	1	1
		C	1	1
		D	1	
MP-036	GRAMINOID	A		1
		B	1	
		C	1	1
		D	1	1
MP-042	GRAMINOID	A		1
		B	1	
		C	1	
		D	1	1
MP-051	GRAMINOID	A		1
		B	1	1
		C	1	1
		D	1	
MP-053	GRAMINOID	A	1	1
		B	1	
		C	1	
		D	1	1
MP-056	GRAMINOID	A	1	1
		B	1	1
		C	1	
		D	1	
MP-057	GRAMINOID	A		1
		B	1	
		C	1	
		D	1	
MP-058	GRAMINOID	A	1	1
		B	1	1
		C	1	
		D	1	
MP-059	GRAMINOID	A		1
		B	1	1
		C	1	1
		D	1	
MP-060	GRAMINOID	A	1	1
		B	1	
		C	1	
		D	1	1
MP-062	GRAMINOID	A		1
		B	1	1
		C	1	
		D	1	1
MP-065	GRAMINOID	A		1
		B	1	1
		C	1	
		D	1	2
MP-066	GRAMINOID	A	1	1
		B	1	
		C	1	1
		D	1	
MP-067	GRAMINOID	A	1	1
		B	1	
		C	1	
		D	1	1
MP-068	GRAMINOID	A	1	1
		B	1	
		C	1	
		D	1	1
MP-069	GRAMINOID	A	1	1
		B	1	
		C	1	
		D	1	1
MP-070	GRAMINOID	A	1	1
		B	1	
		C	1	1
		D	1	1
MP-071	GRAMINOID	A	1	1
		B	1	1
		C	1	
		D	1	
MP-072	GRAMINOID	A	1	1
		B	1	1
		C	1	
		D	1	
MP-077	GRAMINOID	A		1
		B	1	1
		C	1	
		D	1	1
MP-078	GRAMINOID	A		1
		B	1	1
		C	1	
		D	1	1
MP-079	GRAMINOID	A		1
		B	1	1
		C	1	1
		D		1
MP-100	GRAMINOID	A	1	1
		B	1	1
		C	1	
		D		1

List of weights for Forbs by plot, subplot, and period.

Sum of WEIGHT			PERIOD	
Plot ID	LIFE FORM	CLIP PLOT	1	2.00
MP-018	FORB	A	0	0.70
		B		0.34
		C	0.32	0.22
		D		0.44
MP-019	FORB	A	13.01	
		B	1.07	7.40
		C		5.60
		D	2.9	5.37
MP-021	FORB	A	8.09	7.85
		B	0	3.60
		C		11.08
		D		17.13
MP-022	FORB	A		47.12
		B		54.37
		C	5.02	16.14
		D	3.06	8.66
MP-024	FORB	A	4.76	29.23
		B		0.25
		C		0.90
		D	0.82	1.59
MP-033	FORB	A	0.45	0.60
		B	4.49	3.12
		C		0.98
		D		3.12
MP-034	FORB	A	8.11	15.59
		B		6.96
		C		15.21
		D	10.89	7.91
MP-035	FORB	A	0	0.00
		B	0	0.00
		C		1.00
		D		0.00
MP-036	FORB	A		16.46
		B		5.20
		C	0	3.89
		D	3.05	2.98
MP-042	FORB	A	0.01	2.91
		B		0.70
		C		0.03
		D	0.01	0.04
MP-051	FORB	A		0.00
		B	0	0.00
		C	3.74	1.33
		D		13.88
MP-053	FORB	A	0	2.65
		B		0.01
		C		0.00
		D	0.02	0.05
MP-056	FORB	A	0	0.00
		B	0	0.19
		C		0.00
		D		0.00
MP-057	FORB	A		19.15
		B		16.67
		C		35.75
		D		28.94
MP-058	FORB	A	0.73	0.35
		B	0.6	0.47
		C		0.17
		D		4.95
MP-059	FORB	A		0.52
		B	0.43	12.20
		C	1.4	17.25
		D		42.50
MP-060	FORB	A	0.01	0.00
		B		2.87
		C		33.68
		D	0.15	0.31
MP-062	FORB	A		30.48
		B	0.06	0.00
		C		0.29
		D	2	3.61
MP-065	FORB	A		0.00
		B	0.04	0.00
		C		0.00
		D	0	0.00
MP-066	FORB	A	0	0.00
		B		0.00
		C	0	0.00
		D		0.00
MP-067	FORB	A	0.99	3.86
		B		28.09
		C		0.69
		D	0	2.86
MP-068	FORB	A	1.23	5.97
		B		2.20
		C		1.79
		D	0.13	2.55
MP-069	FORB	A	0.32	2.58
		B		2.43
		C		15.93
		D	0.84	3.97
MP-070	FORB	A	0	0.00
		B		0.22
		C		0.38
		D	1	2.45
MP-071	FORB	A	0	0.00
		B	0	0.00
		C		0.00
		D		0.00
MP-072	FORB	A	2.23	16.49
		B	3.16	33.53
		C		12.02
		D		23.20
MP-077	FORB	A		6.80
		B	2.76	5.56
		C		14.24
		D	0.01	0.35
MP-078	FORB	A		2.98
		B	1.24	2.94
		C		6.73
		D	4	6.89
MP-079	FORB	A		13.69
		B	1.07	14.98
		C	4.4	12.64
		D		3.49
MP-100	FORB	A	10.79	23.71
		B	11.12	38.02
		C		19.12
		D		16.40

List of weights for Graminoids by plot, subplot, and period.

Sum of WEIGHT			PERIOD	
Plot ID	LIFE FORM	CLIP PLOT	1	2.00
MP-018	GRAMINOID	A	35.06	72.39
		B		57.44
		C	49.17	79.16
		D		81.53
MP-019	GRAMINOID	A		56.95
		B	5.55	10.42
		C		32.82
		D	13.14	9.47
MP-021	GRAMINOID	A	0.92	1.52
		B	0.25	2.14
		C		14.61
		D		15.97
MP-022	GRAMINOID	A		27.96
		B		12.96
		C	2.98	7.45
		D	18.73	17.01
MP-024	GRAMINOID	A	41.97	24.48
		B		83.77
		C		33.59
		D	9.13	10.42
MP-033	GRAMINOID	A	48.3	76.39
		B	53.68	103.72
		C		162.98
		D		193.70
MP-034	GRAMINOID	A	0.03	0.17
		B		3.66
		C		15.25
		D	17.79	7.30
MP-035	GRAMINOID	A	0	3.54
		B	13.15	17.57
		C		34.96
		D		0.57
MP-036	GRAMINOID	A		14.17
		B		52.05
		C	22.47	23.84
		D	12.92	8.84
MP-042	GRAMINOID	A	0	9.79
		B		25.60
		C		70.21
		D	11.13	45.38
MP-051	GRAMINOID	A		18.81
		B	5.4	4.51
		C	10.67	7.02
		D		27.59
MP-053	GRAMINOID	A	0.01	1.17
		B		30.53
		C		1.75
		D	0.1	0.69
MP-056	GRAMINOID	A	0	0.00
		B	16.24	8.42
		C		0.00
		D		41.23
MP-057	GRAMINOID	A		29.94
		B		5.68
		C		6.08
		D		16.13
MP-058	GRAMINOID	A	11.21	16.58
		B	9.37	4.69
		C		1.02
		D		0.43
MP-059	GRAMINOID	A		5.43
		B	7.42	5.87
		C	3.4	11.17
		D		13.11
MP-060	GRAMINOID	A		5.32 11.27
		B		13.00
		C		14.46
		D	5.14	11.74
MP-062	GRAMINOID	A		22.28
		B	10.92	20.90
		C		23.81
		D	10.37	8.32
MP-065	GRAMINOID	A		269.09
		B	67.45	213.64
		C		142.39
		D	61.27	117.55
MP-066	GRAMINOID	A	0	28.74
		B		0.86
		C	0.04	0.55
		D		16.45
MP-067	GRAMINOID	A	0.04	0.54
		B		9.93
		C		11.82
		D	0.08	0.47
MP-068	GRAMINOID	A	12.95	10.75
		B		21.91
		C		30.86
		D	15.08	15.03
MP-069	GRAMINOID	A	18.11	6.24
		B		23.42
		C		16.63
		D	20.72	9.94
MP-070	GRAMINOID	A	23.95	15.80
		B		17.90
		C		0.00
		D	7.21	2.20
MP-071	GRAMINOID	A	0	0.00
		B	0	0.00
		C		0.00
		D		0.00
MP-072	GRAMINOID	A	10.03	10.83
		B	7.75	16.44
		C		25.34
		D		26.42
MP-077	GRAMINOID	A		22.44
		B	16.8	21.98
		C		29.45
		D	18.97	13.58
MP-078	GRAMINOID	A		8.82
		B	3.97	7.06
		C		17.09
		D	1.87	2.91
MP-079	GRAMINOID	A		35.54
		B	9.91	13.78
		C	28.7	10.21
		D		23.22
MP-100	GRAMINOID	A	2.71	1.87
		B	2.98	2.00
		C		16.25
		D		35.29

Mean weights by plot, life form, and period.

Mean WEIGHT (g)		PERIOD	
Plot ID	LIFE FORM	1	2
MP-018	FORB	0.16	0.43
	GRAMINOID	42.12	72.63
MP-019	FORB	1.99	7.35
	GRAMINOID	9.35	27.42
MP-021	FORB	4.05	9.83
	GRAMINOID	0.59	8.96
MP-022	FORB	4.04	31.97
	GRAMINOID	10.88	16.35
MP-024	FORB	2.79	7.99
	GRAMINOID	25.55	38.07
MP-033	FORB	2.47	1.96
	GRAMINOID	50.99	134.20
MP-034	FORB	9.50	11.40
	GRAMINOID	8.91	6.62
MP-035	FORB	0.00	0.25
	GRAMINOID	8.58	14.16
MP-036	FORB	1.53	7.13
	GRAMINOID	17.70	24.73
MP-042	FORB	0.01	0.92
	GRAMINOID	5.57	37.75
MP-051	FORB	1.87	3.90
	GRAMINOID	8.04	14.48
MP-053	FORB	0.01	0.69
	GRAMINOID	0.08	8.54
MP-056	FORB	0.00	0.05
	GRAMINOID	8.12	12.41
MP-057	FORB		25.63
	GRAMINOID		14.91
MP-058	FORB	0.67	1.49
	GRAMINOID	10.29	5.88
MP-059	FORB	0.92	18.12
	GRAMINOID	5.41	8.90
MP-060	FORB	0.08	9.22
	GRAMINOID	5.23	12.62
MP-062	FORB	1.03	8.59
	GRAMINOID	10.65	21.33
MP-065	FORB	0.02	0.00
	GRAMINOID	64.36	152.63
MP-066	FORB	0.00	0.00
	GRAMINOID	0.02	11.65
MP-067	FORB	0.50	8.89
	GRAMINOID	0.06	5.89
MP-068	FORB	0.68	3.13
	GRAMINOID	14.02	19.64
MP-069	FORB	0.58	8.25
	GRAMINOID	19.42	14.06
MP-070	FORB	0.50	0.76
	GRAMINOID	15.58	8.66
MP-071	FORB	0.00	0.00
	GRAMINOID	0.00	0.00
MP-072	FORB	2.70	21.31
	GRAMINOID	8.89	19.76
MP-077	FORB	1.39	7.24
	GRAMINOID	17.89	21.86
MP-078	FORB	2.62	4.99
	GRAMINOID	2.92	8.97
MP-079	FORB	2.74	11.20
	GRAMINOID	19.31	20.89
MP-100	FORB	10.95	24.81
	GRAMINOID	2.85	13.66

THIS PAGE INTENTIONALLY BLANK

Standard deviations of weights.

Mean WEIGHT (g)		PERIOD	
Plot ID	LIFE FORM	1	3
MP-018	FORB	0.23	0.20
	GRAMINOID	9.98	10.84
MP-019	FORB	1.29	4.12
	GRAMINOID	5.37	22.45
MP-021	FORB	5.72	5.75
	GRAMINOID	0.47	7.80
MP-022	FORB	1.39	22.54
	GRAMINOID	11.14	8.68
MP-024	FORB	2.79	14.17
	GRAMINOID	23.22	31.93
MP-033	FORB	2.86	1.35
	GRAMINOID	3.80	53.66
MP-034	FORB	1.97	4.69
	GRAMINOID	12.56	8.47
MP-035	FORB	0.00	0.50
	GRAMINOID	9.30	15.72
MP-036	FORB	2.16	6.28
	GRAMINOID	6.75	19.25
MP-042	FORB	0.00	1.36
	GRAMINOID	7.87	26.08
MP-051	FORB	2.64	6.75
	GRAMINOID	3.73	10.73
MP-053	FORB	0.01	1.31
	GRAMINOID	0.06	14.67
MP-056	FORB	0.00	0.10
	GRAMINOID	11.48	19.62
MP-057	FORB		8.24
	GRAMINOID		11.35
MP-058	FORB	0.09	2.33
	GRAMINOID	1.30	7.51
MP-059	FORB	0.69	17.70
	GRAMINOID	2.84	3.83
MP-060	FORB	0.10	16.36
	GRAMINOID	0.13	1.43
MP-062	FORB	1.37	14.67
	GRAMINOID	0.39	9.92
MP-065	FORB	0.03	0.00
	GRAMINOID	4.37	100.09
MP-066	FORB	0.00	0.00
	GRAMINOID	0.03	13.69
MP-067	FORB	0.70	12.89
	GRAMINOID	0.03	8.04
MP-068	FORB	0.78	1.92
	GRAMINOID	1.51	8.78
MP-069	FORB	0.37	6.51
	GRAMINOID	1.85	7.58
MP-070	FORB	0.71	1.14
	GRAMINOID	11.84	9.18
MP-071	FORB	0.00	0.00
	GRAMINOID	0.00	0.00
MP-072	FORB	0.66	9.39
	GRAMINOID	1.61	7.44
MP-077	FORB	1.94	5.82
	GRAMINOID	1.53	6.49
MP-078	FORB	1.95	2.22
	GRAMINOID	1.48	5.95
MP-079	FORB	2.35	5.23
	GRAMINOID	13.29	11.32
MP-100	FORB	5.23	9.11
	GRAMINOID	0.19	15.80

First Harvest

Mean WEIGHT (g)		PERIOD
Plot ID	LIFE FORM	1
MP-018	FORB	0.16
MP-019	FORB	1.99
MP-021	FORB	4.05
MP-022	FORB	4.04
MP-024	FORB	2.79
MP-033	FORB	2.47
MP-034	FORB	9.50
MP-035	FORB	0.00
MP-036	FORB	1.53
MP-042	FORB	0.01
MP-051	FORB	1.87
MP-053	FORB	0.01
MP-056	FORB	0.00
MP-057	FORB	
MP-058	FORB	0.67
MP-059	FORB	0.92
MP-060	FORB	0.08
MP-062	FORB	1.03
MP-065	FORB	0.02
MP-066	FORB	0.00
MP-067	FORB	0.50
MP-068	FORB	0.68
MP-069	FORB	0.58
MP-070	FORB	0.50
MP-071	FORB	0.00
MP-072	FORB	2.70
MP-077	FORB	1.39
MP-078	FORB	2.62
MP-079	FORB	2.74
MP-100	FORB	10.96

Mean WEIGHT (g)		PERIOD
Plot ID	LIFE FORM	1
MP-018	GRAMINOID	42.12
MP-019	GRAMINOID	9.35
MP-021	GRAMINOID	0.59
MP-022	GRAMINOID	10.86
MP-024	GRAMINOID	25.55
MP-033	GRAMINOID	50.99
MP-034	GRAMINOID	8.91
MP-035	GRAMINOID	6.58
MP-036	GRAMINOID	17.70
MP-042	GRAMINOID	5.57
MP-051	GRAMINOID	8.04
MP-053	GRAMINOID	0.06
MP-056	GRAMINOID	8.12
MP-057	GRAMINOID	
MP-058	GRAMINOID	10.29
MP-059	GRAMINOID	5.41
MP-060	GRAMINOID	5.23
MP-062	GRAMINOID	10.65
MP-065	GRAMINOID	64.36
MP-066	GRAMINOID	0.02
MP-067	GRAMINOID	0.06
MP-068	GRAMINOID	14.02
MP-069	GRAMINOID	19.42
MP-070	GRAMINOID	15.58
MP-071	GRAMINOID	0.00
MP-072	GRAMINOID	8.89
MP-077	GRAMINOID	17.89
MP-078	GRAMINOID	2.92
MP-079	GRAMINOID	19.31
MP-100	GRAMINOID	2.85

Second Harv

Plot ID	Forbs	Graminoids	Herbaceous
MP-018	0.34	57.44	57.78
MP-018	0.44	81.53	81.97
MP-019	13.01	56.95	69.96
MP-019	5.60	32.82	38.42
MP-021	11.08	14.61	25.69
MP-021	17.13	15.97	33.10
MP-022	47.12	27.96	75.08
MP-022	54.37	12.96	67.33
MP-024	0.25	83.77	84.02
MP-024	0.90	33.59	34.49
MP-033	0.98	162.98	163.96
MP-033	3.12	193.70	196.82
MP-034	6.96	3.66	10.62
MP-034	15.21	15.25	30.46
MP-035	1.00	34.96	35.96
MP-035	0.00	0.57	0.57
MP-036	16.46	14.17	30.63
MP-036	5.20	52.05	57.25
MP-042	0.70	25.60	26.30
MP-042	0.03	70.21	70.24
MP-051	0.00	18.81	18.81
MP-051	13.88	27.59	41.47
MP-053	0.07	30.53	30.60
MP-053	0.00	1.75	1.75
MP-056	0.00	0.00	0.00
MP-056	0.00	41.23	41.23
MP-057	19.15	29.94	49.09
MP-057	18.67	5.88	24.55
MP-057	35.75	6.08	41.83
MP-057	28.94	16.13	45.07
MP-058	0.17	1.02	1.19
MP-058	4.98	0.43	5.41
MP-059	0.52	5.43	5.95
MP-059	42.50	13.11	55.61
MP-060	2.87	13.00	15.87
MP-060	33.68	14.46	48.14
MP-062	30.46	32.28	62.74
MP-062	0.29	23.81	24.10
MP-065	0.00	289.09	289.09
MP-065	0.00	142.39	142.39
MP-066	0.00	0.86	0.86
MP-066	0.00	16.45	16.45
MP-067	28.09	9.93	38.02
MP-067	0.69	11.82	12.51
MP-068	2.20	21.91	24.11
MP-068	1.79	30.86	32.65
MP-069	2.43	23.42	25.85
MP-069	15.93	16.63	32.56
MP-070	0.22	17.90	18.12
MP-070	0.38	0.00	0.38
MP-071	0.00	0.00	0.00
MP-071	0.00	0.00	0.00
MP-072	12.02	25.34	37.36

MP-072	23.20	26.42	49.62
MP-077	8.80	22.44	31.24
MP-077	14.24	29.45	43.69
MP-078	2.98	8.82	11.80
MP-078	6.73	17.09	23.82
MP-079	13.69	35.54	49.23
MP-079	3.49	23.22	26.71
MP-100	19.12	16.25	35.37
MP-100	18.40	35.29	53.69

x x x x x x x x x x x x x

vest (not clipped in first period)

Mean Forbs	
Plot ID	Total
MP-018	0.39
MP-019	9.31
MP-021	14.11
MP-022	50.75
MP-024	0.58
MP-033	2.05
MP-034	11.09
MP-035	0.50
MP-036	10.83
MP-042	0.37
MP-051	6.94
MP-053	0.04
MP-056	0.00
MP-057	25.63
MP-058	2.58
MP-059	21.51
MP-060	18.28
MP-062	15.38
MP-065	0.00
MP-066	0.00
MP-067	14.39
MP-068	2.00
MP-069	9.18
MP-070	0.30
MP-071	0.00
MP-072	17.61
MP-077	11.52
MP-078	4.86
MP-079	8.59
MP-100	18.76

Mean Graminoids	
Plot ID	Total
MP-018	69.49
MP-019	44.89
MP-021	15.29
MP-022	20.46
MP-024	58.68
MP-033	178.34
MP-034	9.46
MP-035	17.77
MP-036	33.11
MP-042	47.91
MP-051	23.20
MP-053	16.14
MP-056	20.62
MP-057	14.51
MP-058	0.73
MP-059	9.27
MP-060	13.73
MP-062	28.05
MP-065	215.74
MP-066	8.66
MP-067	10.88
MP-068	26.39
MP-069	20.03
MP-070	8.95
MP-071	0.00
MP-072	25.88
MP-077	25.95
MP-078	12.96
MP-079	29.38
MP-100	25.77

Mean Herbaceous	
Plot ID	Total
MP-018	69.88
MP-019	54.19
MP-021	29.40
MP-022	71.21
MP-024	59.26
MP-033	180.39
MP-034	20.54
MP-035	18.27
MP-036	43.94
MP-042	48.27
MP-051	30.14
MP-053	16.18
MP-056	20.62
MP-057	40.14
MP-058	3.30
MP-059	30.78
MP-060	32.01
MP-062	43.42
MP-065	215.74
MP-066	8.66
MP-067	25.27
MP-068	28.38
MP-069	29.21
MP-070	9.25
MP-071	0.00
MP-072	43.49
MP-077	37.47
MP-078	17.81
MP-079	37.97
MP-100	44.53

Plot ID	Forbs	Graminoids	Herbaceous
MP-018	0.70	72.39	73.09
MP-018	0.22	79.16	79.38
MP-019	7.40	10.42	17.82
MP-019	3.37	9.47	12.84
MP-021	7.89	1.52	9.41
MP-021	3.60	2.14	5.74
MP-022	16.14	7.45	23.59
MP-022	8.66	17.01	25.67
MP-024	29.23	24.48	53.71
MP-024	1.59	10.42	12.01
MP-033	0.60	76.39	76.99
MP-033	3.12	103.72	106.84
MP-034	15.59	0.17	15.76
MP-034	7.97	7.39	15.36
MP-035	0.00	3.54	3.54
MP-035	0.00	17.57	17.57
MP-036	3.89	23.84	27.73
MP-036	2.98	8.84	11.82
MP-042	2.91	9.79	12.70
MP-042	0.04	45.38	45.42
MP-051	0.00	4.51	4.51
MP-051	1.33	7.02	8.35
MP-053	2.65	1.17	3.82
MP-053	0.05	0.69	0.74
MP-056	0.00	0.00	0.00
MP-056	0.19	8.42	8.61
MP-057	0.00	0.00	0.00
MP-057	0.00	0.00	0.00
MP-058	0.35	16.58	16.93
MP-058	0.47	4.69	5.16
MP-059	12.20	5.87	18.07
MP-059	17.25	11.17	28.42
MP-060	0.00	11.27	11.27
MP-060	0.31	11.74	12.05
MP-062	0.00	20.90	20.90
MP-062	3.61	8.32	11.93
MP-065	0.00	213.64	213.64
MP-065	0.00	117.55	117.55
MP-066	0.00	28.74	28.74
MP-066	0.00	0.55	0.55
MP-067	3.86	0.54	4.40
MP-067	2.86	0.47	3.33
MP-068	5.97	10.75	16.72
MP-068	2.55	15.03	17.58
MP-069	2.58	6.24	8.82
MP-069	3.97	9.94	13.91
MP-070	0.00	15.80	15.80
MP-070	2.45	2.20	4.65
MP-071	0.00	0.00	0.00
MP-071	0.00	0.00	0.00
MP-072	16.49	10.83	27.32
MP-072	33.53	16.44	49.97
MP-077	5.56	21.98	27.54

MP-077	0.35	13.58	13.93
MP-078	2.94	7.06	10.00
MP-078	6.89	2.91	9.80
MP-079	14.98	13.78	28.76
MP-079	12.64	10.21	22.85
MP-100	23.71	1.87	25.58
MP-100	38.02	2.00	40.02

x x x x x x x x x x x x x x

Regrowth

Mean Forbs	
Plot ID	Total
MP-018	0.46
MP-019	5.39
MP-021	5.75
MP-022	12.40
MP-024	15.41
MP-033	1.86
MP-034	11.78
MP-035	0.00
MP-036	3.44
MP-042	1.48
MP-051	0.67
MP-053	1.35
MP-056	0.10
MP-057	0.00
MP-058	0.41
MP-059	14.73
MP-060	0.16
MP-062	1.81
MP-065	0.00
MP-066	0.00
MP-067	3.36
MP-068	4.26
MP-069	3.28
MP-070	1.23
MP-071	0.00
MP-072	25.01
MP-077	2.96
MP-078	4.92
MP-079	13.81
MP-100	30.87

Mean Graminoids	
Plot ID	Total
MP-018	75.78
MP-019	9.95
MP-021	1.83
MP-022	12.23
MP-024	17.45
MP-033	90.06
MP-034	3.78
MP-035	10.56
MP-036	16.34
MP-042	27.59
MP-051	5.77
MP-053	0.93
MP-056	4.21
MP-057	0.00
MP-058	10.64
MP-059	8.52
MP-060	11.51
MP-062	14.61
MP-065	165.60
MP-066	14.65
MP-067	0.51
MP-068	12.89
MP-069	8.09
MP-070	9.00
MP-071	0.00
MP-072	13.64
MP-077	17.78
MP-078	4.99
MP-079	12.00
MP-100	1.94

Mean Herbaceous	
Plot ID	Total
MP-018	76.24
MP-019	15.33
MP-021	7.58
MP-022	24.63
MP-024	32.86
MP-033	91.92
MP-034	15.56
MP-035	10.56
MP-036	19.78
MP-042	29.06
MP-051	6.43
MP-053	2.28
MP-056	4.31
MP-057	0.00
MP-058	11.05
MP-059	23.25
MP-060	11.66
MP-062	16.42
MP-065	165.60
MP-066	14.65
MP-067	3.87
MP-068	17.15
MP-069	11.37
MP-070	10.23
MP-071	0.00
MP-072	38.65
MP-077	20.74
MP-078	9.90
MP-079	25.81
MP-100	32.80

First plus Second

Plot ID	Forbs	Graminoids	Herbaceous
MP-018	0.70	107.45	108.15
MP-018	0.54	128.33	128.87
MP-019	8.47	15.97	24.44
MP-019	6.27	22.61	28.88
MP-021	15.98	2.44	18.42
MP-021	3.60	2.39	5.99
MP-022	21.16	10.43	31.59
MP-022	11.72	35.74	47.46
MP-024	33.99	66.45	100.44
MP-024	2.41	19.55	21.96
MP-033	1.05	124.69	125.74
MP-033	7.61	157.4	165.01
MP-034	23.70	0.2	23.90
MP-034	18.86	25.18	44.04
MP-035	0.00	3.54	3.54
MP-035	0.00	30.72	30.72
MP-036	3.89	46.31	50.20
MP-036	6.03	21.76	27.79
MP-042	2.92	9.79	12.71
MP-042	0.05	56.51	56.56
MP-051	0.00	9.91	9.91
MP-051	5.07	17.69	22.76
MP-053	2.65	1.18	3.83
MP-053	0.07	0.79	0.86
MP-056	0.00	0	0.00
MP-056	0.19	24.66	24.85
MP-057	0.00	0	0.00
MP-057	0.00	0	0.00
MP-058	1.08	27.79	28.87
MP-058	1.07	14.06	15.13
MP-059	12.63	13.29	25.92
MP-059	18.65	14.57	33.22
MP-060	0.01	16.59	16.60
MP-060	0.46	16.88	17.34
MP-062	0.06	31.82	31.88
MP-062	5.61	18.69	24.30
MP-065	0.04	281.09	281.13
MP-065	0.00	178.82	178.82
MP-066	0.00	28.74	28.74
MP-066	0.00	0.59	0.59
MP-067	4.85	0.58	5.43
MP-067	2.86	0.55	3.41
MP-068	7.20	23.7	30.90
MP-068	2.68	30.11	32.79
MP-069	2.90	24.35	27.25
MP-069	4.81	30.66	35.47
MP-070	0.00	39.75	39.75
MP-070	3.45	9.41	12.86
MP-071	0.00	0	0.00
MP-071	0.00	0	0.00
MP-072	18.72	20.86	39.58
MP-072	36.69	24.19	60.88
MP-077	8.32	38.78	47.10

MP-077	0.36	32.55	32.91
MP-078	4.18	11.03	15.21
MP-078	10.89	4.78	15.67
MP-079	16.05	23.69	39.74
MP-079	17.04	38.91	55.95
MP-100	34.50	4.58	39.08
MP-100	49.14	4.98	54.12

x x x x x x x x x x x x x x

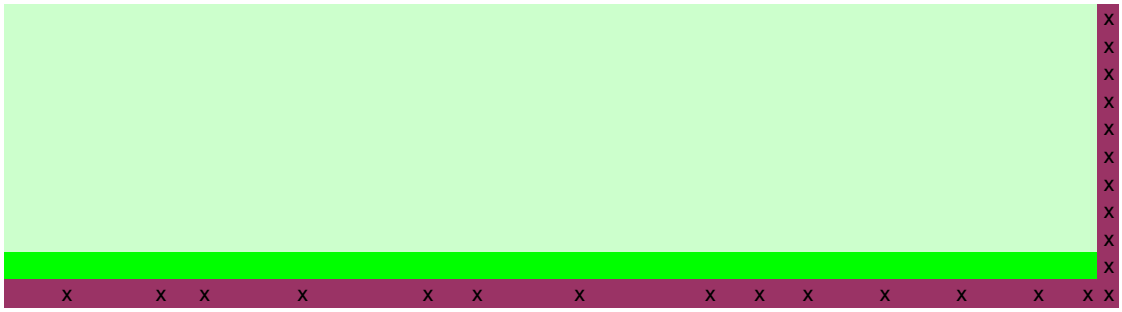
Harvest of those clipped in first period

Mean Forbs	
Plot ID	Total
MP-018	0.62
MP-019	7.37
MP-021	9.79
MP-022	16.44
MP-024	18.20
MP-033	4.33
MP-034	21.28
MP-035	0.00
MP-036	4.96
MP-042	1.49
MP-051	2.54
MP-053	1.36
MP-056	0.10
MP-057	0.00
MP-058	1.08
MP-059	15.64
MP-060	0.24
MP-062	2.84
MP-065	0.02
MP-066	0.00
MP-067	3.86
MP-068	4.94
MP-069	3.86
MP-070	1.73
MP-071	0.00
MP-072	27.71
MP-077	4.34
MP-078	7.54
MP-079	16.55
MP-100	41.82

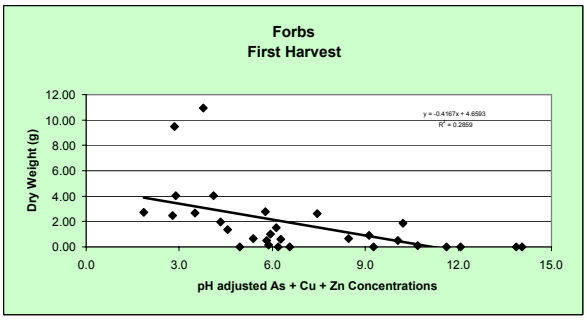
Mean Graminoids	
Plot ID	Total
MP-018	117.89
MP-019	19.29
MP-021	2.42
MP-022	23.09
MP-024	43.00
MP-033	141.05
MP-034	12.69
MP-035	17.13
MP-036	34.04
MP-042	33.15
MP-051	13.80
MP-053	0.99
MP-056	12.33
MP-057	0.00
MP-058	20.93
MP-059	13.93
MP-060	16.74
MP-062	25.26
MP-065	229.96
MP-066	14.67
MP-067	0.57
MP-068	26.91
MP-069	27.51
MP-070	24.58
MP-071	0.00
MP-072	22.53
MP-077	35.67
MP-078	7.91
MP-079	31.30
MP-100	4.78

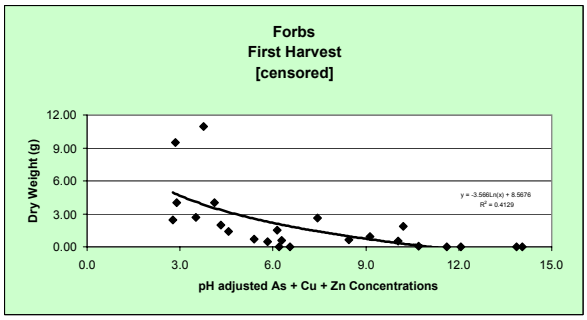
Mean Herbaceous	
Plot ID	Total
MP-018	118.51
MP-019	26.66
MP-021	12.21
MP-022	39.53
MP-024	61.20
MP-033	145.38
MP-034	33.97
MP-035	17.13
MP-036	39.00
MP-042	34.64
MP-051	16.34
MP-053	2.35
MP-056	12.43
MP-057	0.00
MP-058	22.00
MP-059	29.57
MP-060	16.97
MP-062	28.09
MP-065	229.98
MP-066	14.67
MP-067	4.42
MP-068	31.85
MP-069	31.36
MP-070	26.31
MP-071	0.00
MP-072	50.23
MP-077	40.01
MP-078	15.44
MP-079	47.85
MP-100	46.60

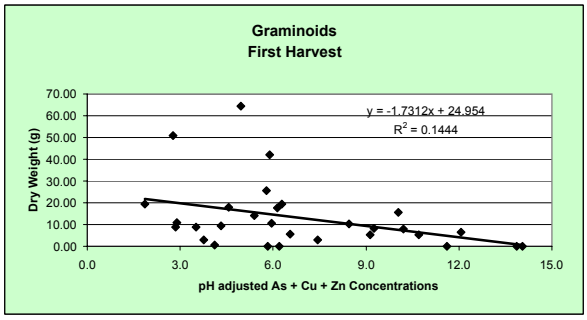
Plot ID	Forbs	Gramin	Herbacec
MP-018	0.51	93.69	94.19
MP-019	8.34	32.09	40.43
MP-021	11.95	8.85	20.80
MP-022	33.59	21.77	55.37
MP-024	9.39	50.84	60.23
MP-033	3.19	159.69	162.88
MP-034	16.18	11.07	27.26
MP-035	0.25	17.45	17.70
MP-036	7.90	33.57	41.47
MP-042	0.93	40.53	41.45
MP-051	4.74	18.50	23.24
MP-053	0.70	8.56	9.26
MP-056	0.05	16.47	16.52
MP-057	12.81	7.25	20.07
MP-058	1.83	10.83	12.65
MP-059	18.58	11.60	30.18
MP-060	9.26	15.23	24.49
MP-062	9.11	26.65	35.76
MP-065	0.01	222.85	222.86
MP-066	0.00	11.66	11.66
MP-067	9.12	5.72	14.84
MP-068	3.47	26.65	30.11
MP-069	6.52	23.77	30.28
MP-070	1.01	16.77	17.78
MP-071	0.00	0.00	0.00
MP-072	22.66	24.20	46.86
MP-077	7.93	30.81	38.74
MP-078	6.20	10.43	16.63
MP-079	12.57	30.34	42.91
MP-100	30.29	15.28	45.57

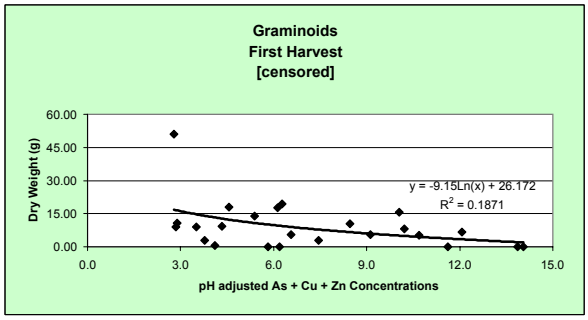


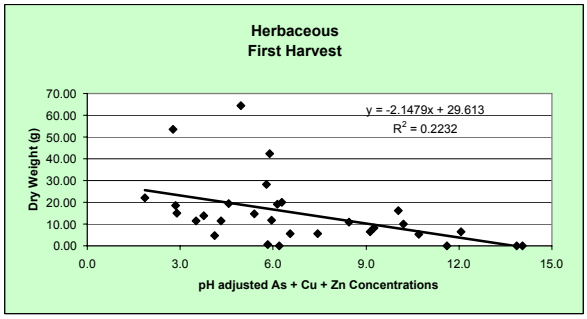
Values copied from Chemistry Table					Clip plot data summaries															
					First Harvest			Second Harvest			Regrowth			Productivity			Standing Crop			
Sample	pH	Org.C. (%)	Factor	Edited	Forbs First Harvest	Graminoids First Harvest	Herbaceous First Harvest	Forbs Second Harvest	Graminoids Second Harvest	Herbaceous Second Harvest	Forbs Regrowth	Graminoids Regrowth	Herbaceous Regrowth	Forbs Productivity	Graminoids Productivity	Herbaceous Productivity	Forbs Standing Crop	Graminoids Standing Crop	Herbaceous Standing Crop	
MP-018	7.28	10.9	5.9		0.16	42.12	42.28	0.39	69.49	69.88	0.46	75.78	76.24	0.62	117.89	118.51	0.51	93.69	94.19	x
MP-019	7.53	3.2	4.3	4.3	1.99	9.35	11.33	9.31	44.89	54.19	5.39	9.95	15.33	7.37	19.29	26.66	8.34	32.09	40.43	x
MP-021	7.24	0.9	4.1	4.1	4.05	0.59	4.63	14.11	15.29	29.40	5.75	1.83	7.58	9.79	2.42	12.21	11.95	8.85	20.80	x
MP-022	7.77	2.5	2.9	2.9	4.04	10.86	14.90	50.75	20.46	71.21	12.40	12.23	24.63	16.44	23.09	39.53	33.59	21.77	55.37	x
MP-024	7.27	14.6	5.8		2.79	25.55	28.34	0.58	58.68	59.26	15.41	17.45	32.86	18.20	43.00	61.20	9.39	50.84	60.23	x
MP-033	7.56	4.6	2.8	2.8	2.47	50.99	53.46	2.05	178.34	180.39	1.86	90.06	91.92	4.33	141.05	145.38	3.19	159.69	162.88	x
MP-034	7.59	1.0	2.9	2.9	9.50	8.91	18.41	11.09	9.46	20.54	11.78	3.78	15.56	21.28	12.69	33.97	16.18	11.07	27.26	x
MP-035	5.09	2.9	12.1	12.1	0.00	6.58	6.58	0.50	17.77	18.27	0.00	10.56	10.56	0.00	17.13	17.13	0.25	17.45	17.70	x
MP-036	6.95	4.9	6.1	6.1	1.53	17.70	19.22	10.83	33.11	43.94	3.44	16.34	19.78	4.96	34.04	39.00	7.90	33.57	41.47	x
MP-042	6.62	6.2	6.6	6.6	0.01	5.57	5.58	0.37	47.91	48.27	1.48	27.58	29.06	1.49	33.15	34.64	0.93	40.53	41.45	x
MP-051	5.85	2.8	10.2	10.2	1.87	8.04	9.91	6.94	23.20	30.14	0.67	5.77	6.43	2.54	13.80	16.34	4.74	18.50	23.24	x
MP-053	5.20	2.7	11.6	11.6	0.01	0.06	0.07	0.04	16.14	16.18	1.35	0.93	2.28	1.36	0.99	2.35	0.70	8.56	9.26	x
MP-056	6.25	8.8	9.3		0.00	8.12	8.12	0.00	20.62	20.62	0.10	4.21	4.31	0.10	12.33	12.43	0.05	16.47	16.52	x
MP-057	7.32	4.5	6.2	6.2	0.00	0.00	0.00	25.63	14.51	40.14	0.00	0.00	0.00	0.00	0.00	0.00	12.81	7.25	20.07	x
MP-058	6.35	4.4	8.5	8.5	0.67	10.29	10.96	2.58	0.73	3.30	0.41	10.64	11.05	1.08	20.93	22.00	1.83	10.83	12.65	x
MP-059	6.11	5.0	9.1	9.1	0.92	5.41	6.33	21.51	9.27	30.78	14.73	8.52	23.25	15.64	13.93	29.57	18.58	11.60	30.18	x
MP-060	5.30	2.2	10.7	10.7	0.08	5.23	5.31	18.28	13.73	32.01	0.16	11.51	11.66	0.24	16.74	16.97	9.26	15.23	24.49	x
MP-062	7.04	7.6	5.9		1.03	10.65	11.68	15.38	28.05	43.42	1.81	14.61	16.42	2.84	25.26	28.09	9.11	26.66	35.76	x
MP-065	6.98	8.1	5.0		0.02	64.36	64.38	0.00	215.74	215.74	0.00	165.60	165.60	0.02	229.96	229.98	0.01	222.85	222.86	x
MP-066	4.50	1.7	13.9	13.9	0.00	0.02	0.02	0.00	8.66	8.66	0.00	14.65	14.65	0.00	14.67	14.67	0.00	11.66	11.66	x
MP-067	7.29	4.3	5.8	5.8	0.50	0.06	0.56	14.39	10.88	25.27	3.36	0.51	3.87	3.86	0.57	4.42	9.12	5.72	14.84	x
MP-068	7.32	5.9	5.4	5.4	0.68	14.02	14.70	2.00	26.39	28.38	4.26	12.89	17.15	4.94	26.91	31.85	3.47	26.65	30.11	x
MP-069	7.05	4.6	6.3	6.3	0.58	19.42	20.00	9.18	20.03	29.21	3.28	8.09	11.37	3.86	27.51	31.36	6.52	23.77	30.28	x
MP-070	5.76	4.0	10.0	10.0	0.50	15.58	16.08	0.30	8.95	9.25	1.23	9.00	10.23	1.73	24.58	26.31	1.01	16.77	17.78	x
MP-071	4.23	1.3	14.1	14.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	x
MP-072	7.43	1.5	3.5	3.5	2.70	8.89	11.59	17.61	25.88	43.49	25.01	13.64	38.65	27.71	22.53	50.23	22.66	24.20	46.86	x
MP-077	7.50	2.6	4.6	4.6	1.39	17.89	19.27	11.52	25.95	37.47	2.96	17.78	20.74	4.34	35.67	40.01	7.93	30.81	38.74	x
MP-078	6.54	3.0	7.4	7.4	2.62	2.92	5.54	4.86	12.96	17.81	4.92	4.98	9.90	7.54	7.91	15.44	6.20	10.43	16.63	x
MP-079	8.25	2.1	1.9		2.74	19.31	22.04	8.59	29.38	37.97	13.81	12.00	25.81	16.55	31.30	47.85	12.57	30.34	42.91	x
MP-100	7.49	3.1	3.8	3.8	10.96	2.85	13.80	18.76	25.77	44.53	30.87	1.94	32.80	41.82	4.78	46.60	30.29	15.28	45.57	
																				x
				Minimum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	x
				Maximum	10.96	64.36	64.38	50.75	215.74	215.74	30.87	165.60	165.60	41.82	229.96	229.98	33.59	222.85	222.86	x
				Mean	1.79	13.04	14.83	9.25	34.41	43.66	5.56	19.43	24.99	7.35	32.47	39.82	8.30	33.44	41.74	x
				Median	0.80	8.90	11.46	7.77	20.54	31.39	2.41	10.60	15.45	3.86	20.11	28.83	7.21	17.97	30.14	x
																				x
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x x

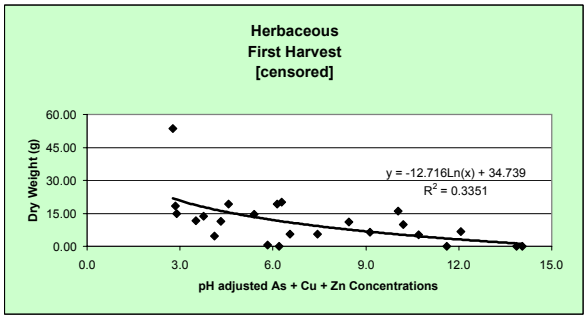

Forbs
First Harvest
y = -0.4167x + 4.6593
R² = 0.2859
Dry Weight (g)
pH adjusted As + Cu + Zn Concentrations

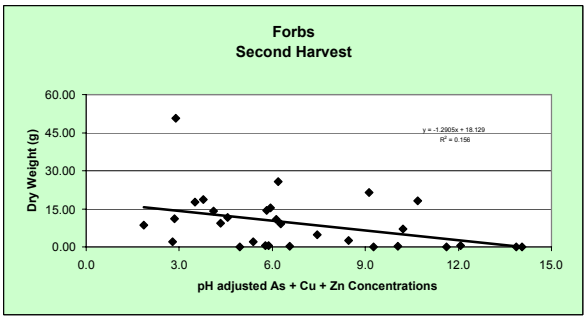

Forbs
First Harvest
[censored]
y = -3.586Ln(x) + 8.5676
R² = 0.4129
Dry Weight (g)
pH adjusted As + Cu + Zn Concentrations

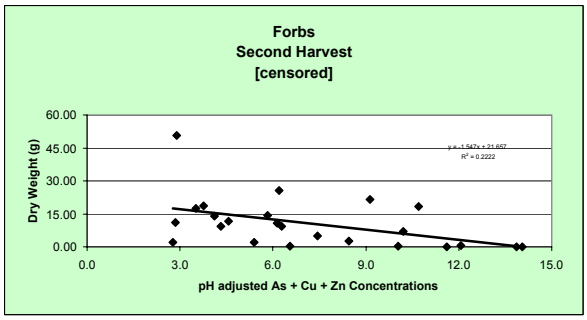

Graminoids
First Harvest
y = -1.7312x + 24.954
R² = 0.1444
Dry Weight (g)
pH adjusted As + Cu + Zn Concentrations

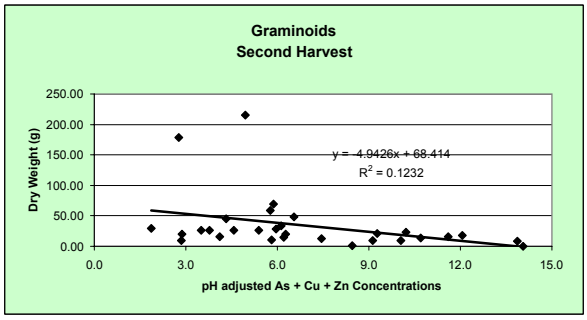

Graminoids
First Harvest
[censored]
y = -9.15Ln(x) + 26.172
R² = 0.1871
Dry Weight (g)
pH adjusted As + Cu + Zn Concentrations

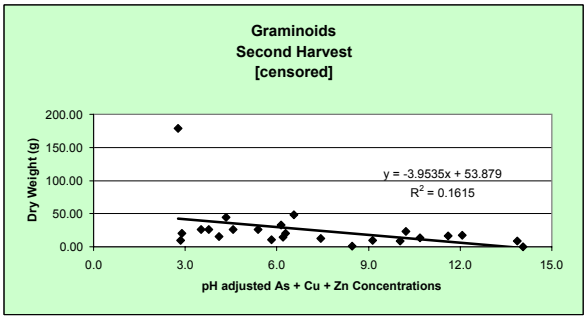

Herbaceous
First Harvest
y = -2.1479x + 29.613
R² = 0.2232
Dry Weight (g)
pH adjusted As + Cu + Zn Concentrations

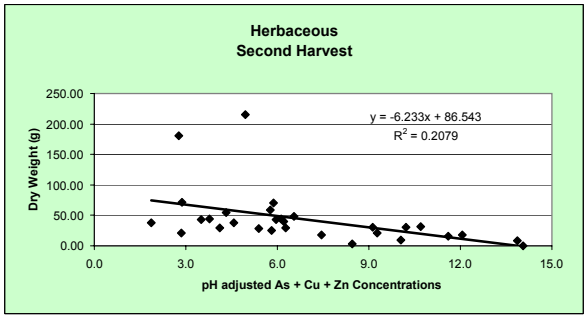

Herbaceous
First Harvest
[censored]
y = -12.716Ln(x) + 34.739
R² = 0.3351
Dry Weight (g)
pH adjusted As + Cu + Zn Concentrations

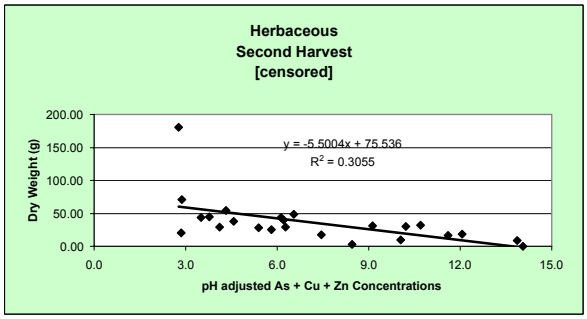

Forbs
Second Harvest
Dry Weight (g)
60.00
45.00
30.00
15.00
0.00
0.0
3.0
6.0
9.0
12.0
15.0
pH adjusted As + Cu + Zn Concentrations
y = -1.2905x + 18.129
R² = 0.158

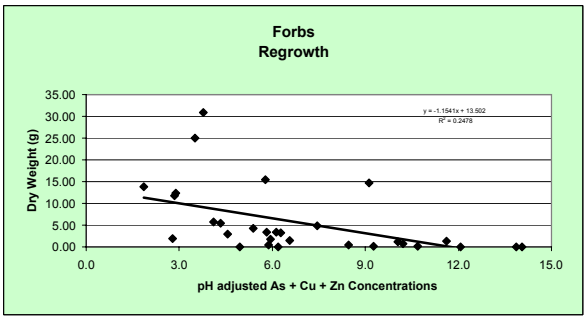

Forbs
Second Harvest
[censored]
Dry Weight (g)
60.00
45.00
30.00
15.00
0.00
0.0
3.0
6.0
9.0
12.0
15.0
pH adjusted As + Cu + Zn Concentrations
y = -1.547x + 21.657
R² = 0.2222

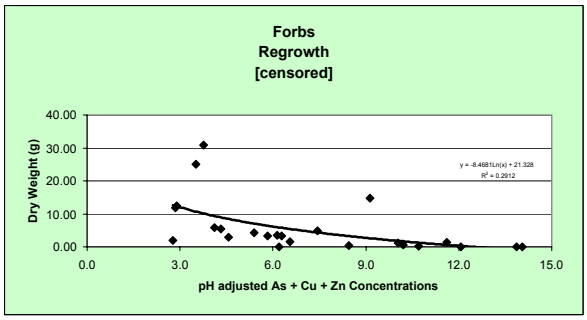

Graminoids
Second Harvest
Dry Weight (g)
250.00
200.00
150.00
100.00
50.00
0.00
0.0
3.0
6.0
9.0
12.0
15.0
pH adjusted As + Cu + Zn Concentrations
y = -4.9426x + 68.414
R² = 0.1232

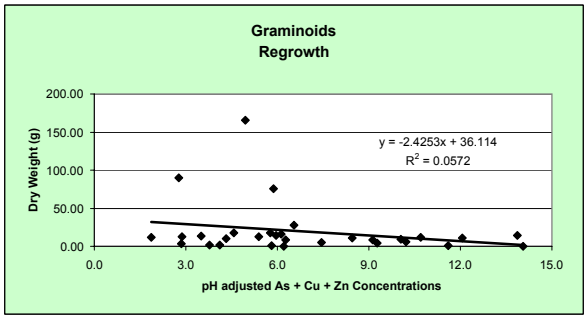

Graminoids
Second Harvest
[censored]
Dry Weight (g)
200.00
150.00
100.00
50.00
0.00
0.0
3.0
6.0
9.0
12.0
15.0
pH adjusted As + Cu + Zn Concentrations
y = -3.9535x + 53.879
R² = 0.1615

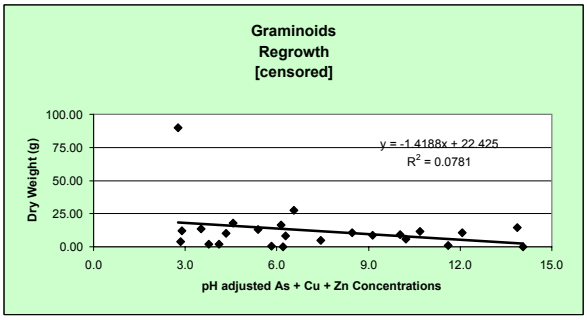

Herbaceous
Second Harvest
Dry Weight (g)
250.00
200.00
150.00
100.00
50.00
0.00
0.0
3.0
6.0
9.0
12.0
15.0
pH adjusted As + Cu + Zn Concentrations
y = -6.233x + 86.543
R² = 0.2079

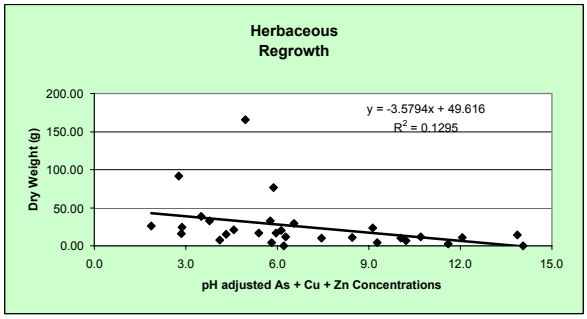

Herbaceous
Second Harvest
[censored]
Dry Weight (g)
200.00
150.00
100.00
50.00
0.00
0.0
3.0
6.0
9.0
12.0
15.0
pH adjusted As + Cu + Zn Concentrations
y = -5.5004x + 75.536
R² = 0.3055

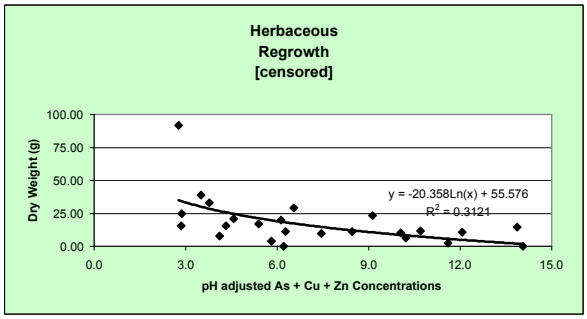

Forbs
Regrowth
y = -1.1541x + 13.502
R² = 0.2478
Dry Weight (g)
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
0.0
3.0
6.0
9.0
12.0
15.0
pH adjusted As + Cu + Zn Concentrations

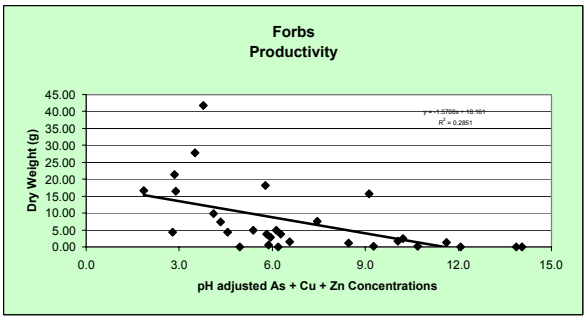

Forbs
Regrowth
[censored]
y = -8.4681Ln(x) + 21.328
R² = 0.2912
Dry Weight (g)
40.00
30.00
20.00
10.00
0.00
0.0
3.0
6.0
9.0
12.0
15.0
pH adjusted As + Cu + Zn Concentrations

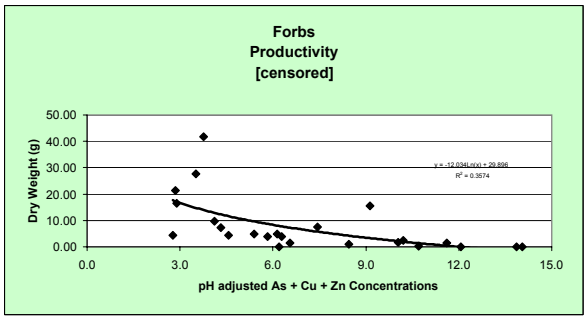

Graminoids
Regrowth
y = -2.4253x + 36.114
R² = 0.0572
Dry Weight (g)
200.00
150.00
100.00
50.00
0.00
0.0
3.0
6.0
9.0
12.0
15.0
pH adjusted As + Cu + Zn Concentrations

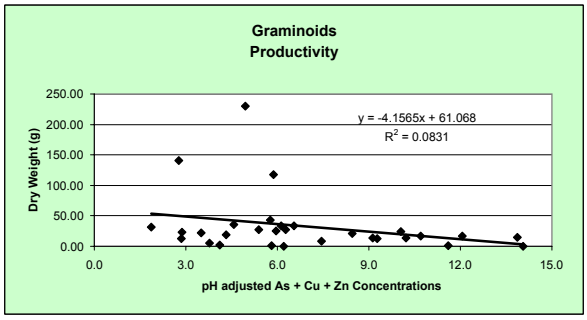

Graminoids
Regrowth
[censored]
y = -1.4188x + 22.425
R² = 0.0781
Dry Weight (g)
100.00
75.00
50.00
25.00
0.00
0.0
3.0
6.0
9.0
12.0
15.0
pH adjusted As + Cu + Zn Concentrations

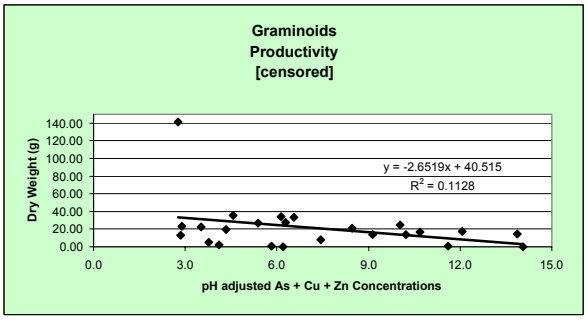

Herbaceous
Regrowth
y = -3.5794x + 49.616
R² = 0.1295
Dry Weight (g)
200.00
150.00
100.00
50.00
0.00
0.0
3.0
6.0
9.0
12.0
15.0
pH adjusted As + Cu + Zn Concentrations

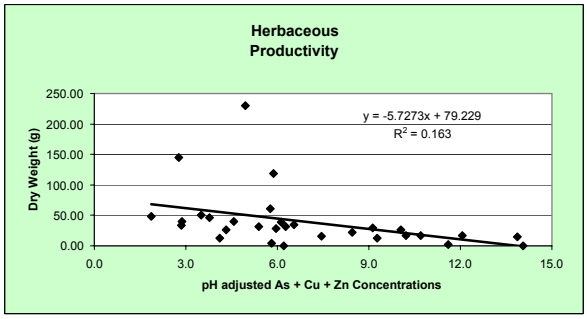

Herbaceous
Regrowth
[censored]
y = -20.358Ln(x) + 55.576
R² = 0.3121
Dry Weight (g)
100.00
75.00
50.00
25.00
0.00
0.0
3.0
6.0
9.0
12.0
15.0
pH adjusted As + Cu + Zn Concentrations

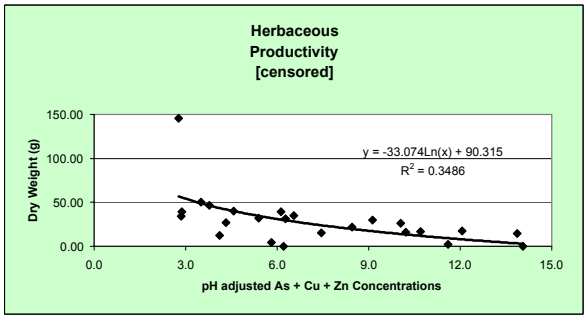

Forbs
Productivity
Dry Weight (g)
pH adjusted As + Cu + Zn Concentrations

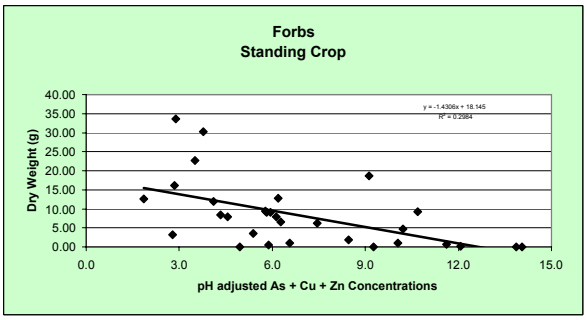

Forbs
Productivity
[censored]
Dry Weight (g)
y = -12.034Ln(x) + 29.896
R2 = 0.3574
pH adjusted As + Cu + Zn Concentrations

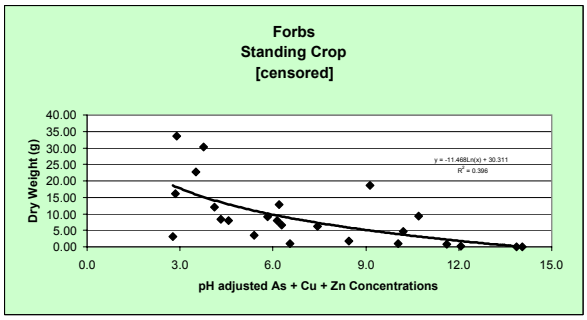

Graminoids
Productivity
Dry Weight (g)
y = -4.1565x + 61.068
R2 = 0.0831
pH adjusted As + Cu + Zn Concentrations

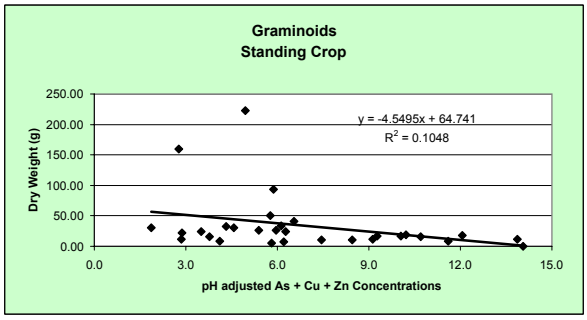

Graminoids
Productivity
[censored]
Dry Weight (g)
y = -2.6519x + 40.515
R2 = 0.1128
pH adjusted As + Cu + Zn Concentrations

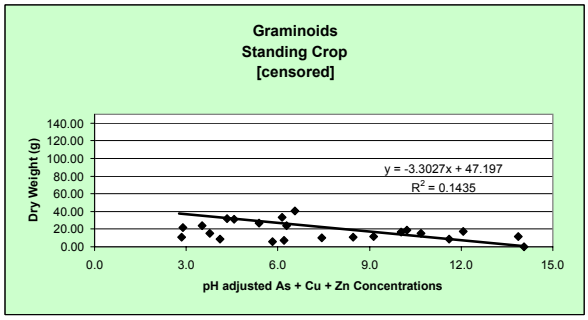

Herbaceous
Productivity
Dry Weight (g)
y = -5.7273x + 79.229
R2 = 0.163
pH adjusted As + Cu + Zn Concentrations

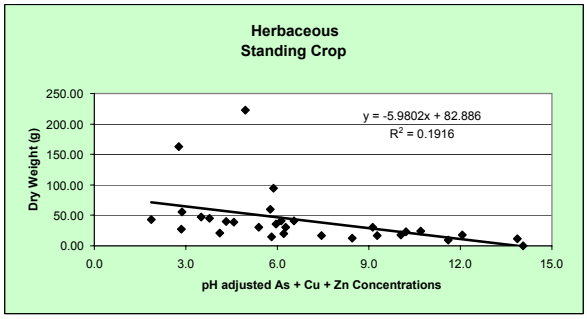

Herbaceous
Productivity
[censored]
Dry Weight (g)
y = -33.074Ln(x) + 90.315
R2 = 0.3486
pH adjusted As + Cu + Zn Concentrations

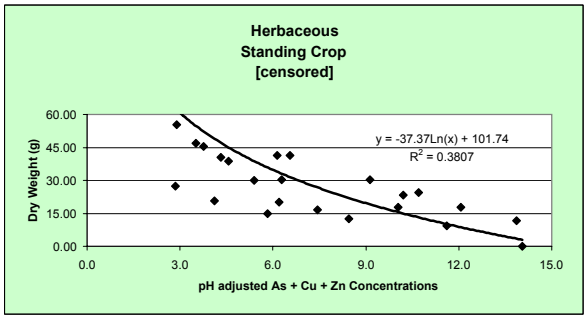

Forbs
Standing Crop
Dry Weight (g)
pH adjusted As + Cu + Zn Concentrations


Forbs
Standing Crop
[censored]
Dry Weight (g)
y = -11.468Ln(x) + 30.311
R² = 0.396
pH adjusted As + Cu + Zn Concentrations


Graminoids
Standing Crop
Dry Weight (g)
y = -4.5495x + 64.741
R2 = 0.1048
pH adjusted As + Cu + Zn Concentrations


Graminoids
Standing Crop
[censored]
Dry Weight (g)
y = -3.3027x + 47.197
R2 = 0.1435
pH adjusted As + Cu + Zn Concentrations


Herbaceous
Standing Crop
Dry Weight (g)
y = -5.9802x + 82.886
R2 = 0.1916
pH adjusted As + Cu + Zn Concentrations


Herbaceous
Standing Crop
[censored]
Dry Weight (g)
y = -37.37Ln(x) + 101.74
R2 = 0.3807
pH adjusted As + Cu + Zn Concentrations

Appendix 6 -- MegaPlot Clip Analyses
Correlation Coefficients

Component	First Harvest	Second Harvest	Regrowth	Productivity	Standing Crop
All Data					
Forbs	0.2859	0.1560	0.2478	0.2851	0.2984
Graminoids	0.1444	0.1232	0.0572	0.0831	0.1048
Herbaceous	0.2232	0.2079	0.1295	0.1630	0.1916
Censored Data					
Forbs	0.4129	0.2222	0.2912	0.3534	0.3960
Graminoids	0.1871	0.1615	0.0781	0.1128	0.1435
Herbaceous	0.3351	0.3055	0.3121	0.3486	0.3807